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**STOPPING  
WATER POLLUTION  
AT ITS SOURCE**



**MISA**

Municipal/Industrial Strategy for Abatement

PBS 2698  
Reference  
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**The Draft Development Document  
for the  
Effluent Limits Regulation  
for the  
Industrial Minerals Sector**

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 **Ontario**

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**THE DRAFT DEVELOPMENT DOCUMENT FOR THE  
EFFLUENT LIMITS REGULATION FOR THE  
INDUSTRIAL MINERALS SECTOR**

OCTOBER 1993



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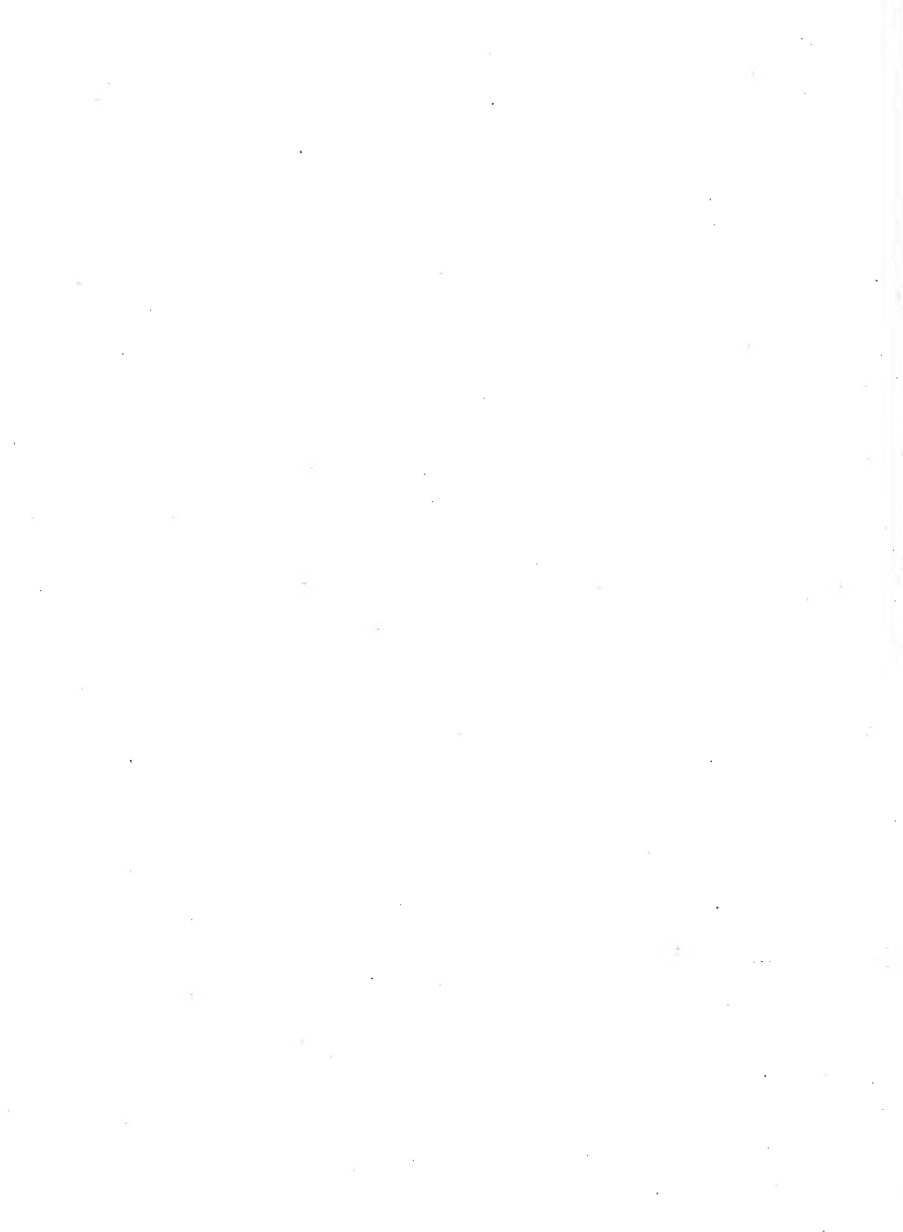
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**THE DRAFT DEVELOPMENT DOCUMENT  
FOR THE EFFLUENT LIMITS REGULATION  
FOR THE INDUSTRIAL MINERALS SECTOR**

Report prepared by:

Water Resources Branch  
Ministry of Environment and Energy



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## **PREFACE**

The Municipal/Industrial Strategy for Abatement (MISA) program is Environment Ontario's program to reduce the discharge of toxic contaminants to Ontario's waterways. Under the first phase of MISA, dischargers were required to monitor and report on the contaminants present in their effluent streams. This information has subsequently been used to set legal discharge limits requiring reductions in toxic discharges to the level attainable with the best available pollution control technology which is economically achievable. The ultimate goal of the MISA program is the virtual elimination of persistent toxic contaminants from all discharges into Ontario's waterways.

This document contains all the legal effluent discharge requirements for Ontario's MISA Industrial Minerals Sector. These requirements are specified in "Ontario Regulation (?)/93: Effluent Monitoring and Effluent Limits - MISA Industrial Minerals Sector". The regulation is issued under the Ontario Environmental Protection Act (Section 136).

The "Ontario Regulation (?)/93: Effluent Monitoring and Effluent Limits - MISA Industrial Minerals Sector" states the quality discharge limits, toxicity testing, flow measurement, and reporting requirements that each direct discharge industrial minerals plant must meet. The regulation comes into force on (?), 1996, allowing industrial mineral plants a period of three (3) years within which to implement pollution control strategies and install those capital works necessary to meet the effluent limits.

Ontario Regulation (?)/93 states that sampling points must be established at each industrial minerals plant site on every process effluent stream, cooling water effluent stream, salt evaporator plant effluent stream and emergency overflow effluent stream. Routine monitoring requirements, designed to provide the Ministry of Environment and Energy with assurance that the industrial mineral plants are meeting the regulation requirements, are tabulated in accompanying schedules.

This document consists of six chapters.

Chapter one of this document is introductory and presents the environmental background to MISA and the main features of the program. A description of the Effluent Monitoring Regulation for the Industrial Minerals Sector is given and the generic effluent limits regulation development process is explained.

Chapter two presents information about the Industrial Minerals Sector. The sector consisted of approximately 116 plants. Plants in the sector produce a variety of materials including portland clinker, cement, lime, gypsum products, talc, graphite, clay brick, roofing granules, magnesium metal, calcium metal, strontium metal,

tal, sand and gravel and crushed stone. The production processes, water use, wastewater sources and wastewater treatment are discussed in this chapter. With the exemption of pits and quarries (sand, gravel, crushed stone, clay and shale) the sector currently consists of 26 plants. The exempted plants will be regulated under other Ministry control instruments.

Chapter three contains information about the effluent monitoring data used in the development of the effluent limits. The chapter includes a summary of the data collected under the one-year regulated MISA effluent monitoring program. A summary of the MISA effluent monitoring database for both regulated and non-regulated plants is presented in Appendix III of this document. Data validation, candidate parameter selection and QA/QC data assessment are also discussed in this chapter.

Chapter four describes the assessment of available pollution control technologies for the control of industrial minerals sector effluent discharges and describes the identification of those technologies considered to be the "best available". Chapter four also examines the economic and financial implications of each of the "best available" technology (BAT) train options, and presents a summary of the likely impact of each BAT option on the sector.

Chapter five presents the effluent limits and describes the limit development process. Existing control requirements are also reviewed along effluent limits present in other jurisdictions.

Chapter six presents a summary of the key components of the Effluent Monitoring and Effluent Limits Regulation for the Industrial Minerals Sector. Compliance requirements and monitoring frequencies are defined, as are other regulation requirements such as toxicity testing criteria and flow measurement accuracy.

This Development Document represents the culmination of over six years of effort on the part of the Provincial and Federal governments, industry, and the public. The public review process was a key component in the development of the Effluent Monitoring and Effluent Limits Regulation for the Industrial Minerals Sector. The draft version of the regulation was released for public review in (?), 1993. In addition to the public review, the draft version of the regulation was reviewed by the MISA Advisory Committee, which is a committee made up of environmental experts external to the Ministry who provide advice directly to the Minister on the contents of the MISA regulations.

## EXECUTIVE SUMMARY

This document describes the steps involved in the development of effluent limits for the Industrial Minerals Sector.

Under the effluent monitoring regulation for the Industrial Minerals Sector, direct dischargers were required to monitor for 150 parameters. A total of 40 parameters were selected as candidate parameters for effluent limit setting for the sector.

To insure that the sampling and analytical data were of reliable quality, a detailed quality assurance and quality control (QA/QC) assessment was then performed on data for the 40 selected candidate parameters. Based on the QA/QC assessment, 6 parameters were removed from further consideration because the assessment showed that their presence in plant effluents was highly suspect.

The Ministry of Environment and Energy commissioned a consultant in May 1991 to identify the best available technology (BAT) for the Ontario industrial mineral plants. A combined study of Ontario plants and plants in other parts of the world was conducted.

It was concluded by the Joint Technical Committee (JTC) that all parameters with the exception of total suspended solids and pH could not be controlled to predictable, quantifiable levels with the identified best available treatment technologies.

The study results were used for the economic impact assessment for the purposes of identifying the implications of imposing the identified BAT on the Industrial Minerals Sector.

From the consultants' experience, literature survey and plant visits, the demonstrated technology most used within the sector for the control of suspended solids is the settling pond.

Based on the information provided by analysing data from the seven "best plants" and the global BAT cement plant, economic analysis and available literature on the environmental effects of suspended solids, it was concluded at the JTC level that the monthly and daily total suspended solids limits for all plants in the industrial minerals sector should be 25 mg/L and 50 mg/L respectively.

All process effluents, cooling water effluents and salt evaporator plant effluents in the industrial minerals sector are required to be non-toxic to rainbow trout and Daphnia magna.

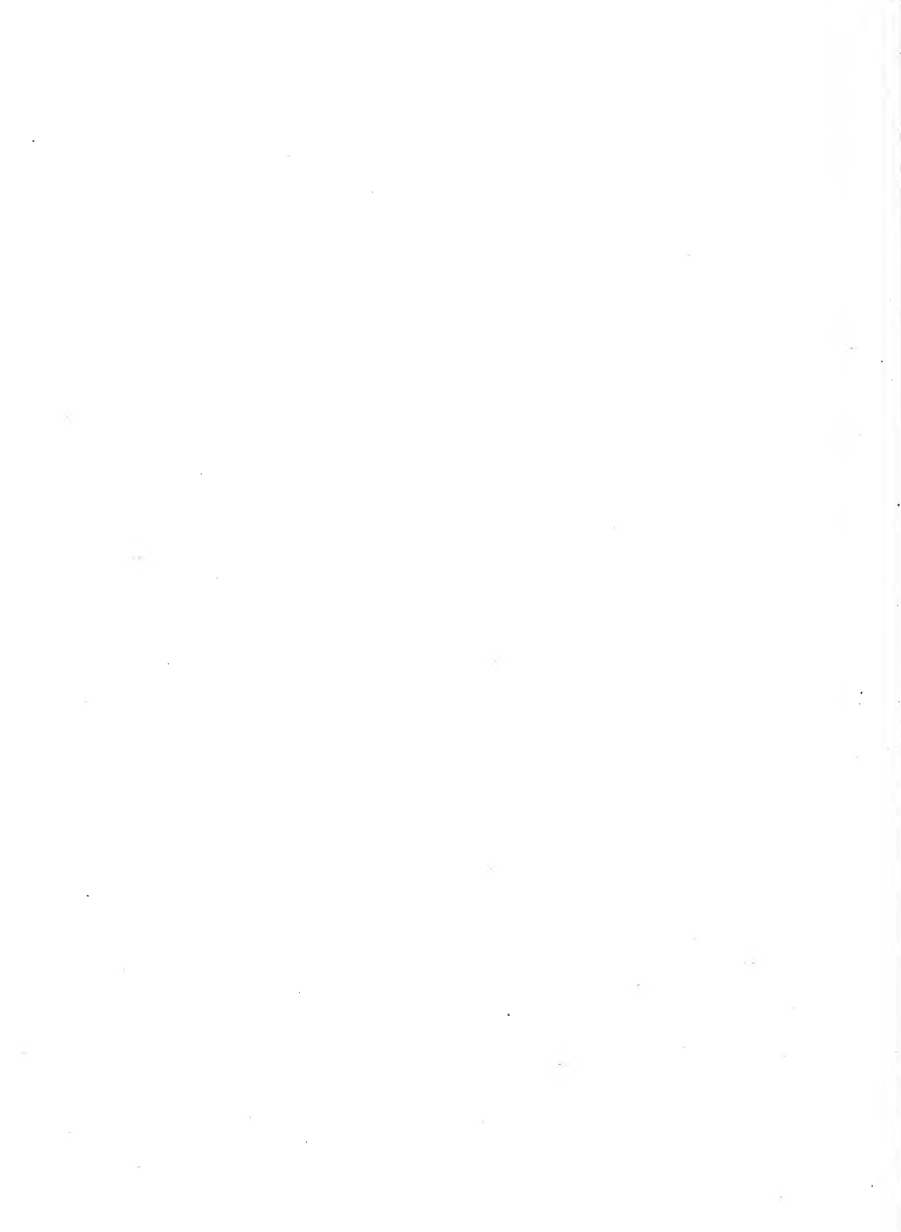
The regulation requires the pH of effluents to be within the range of 6.0 - 9.5.

The environmental benefits expected following industry compliance with the proposed effluent limits include:

- Loadings reductions of suspended solids on an industry-wide basis as a result of the application of the industrial minerals sector effluent limits regulation.
- Reduction of suspended solids will limit degradation of river bottoms which may be currently unsuitable for aquatic life and will reduce deposition on spawning grounds.
- Aesthetic improvements in water and shoreline quality near plant outfalls.
- Turbidity of receiving waters will be decreased enhancing recreational activities.
- Some effluents that are currently acutely lethal due to pH and high levels of suspended solids will be rendered non-acutely lethal to rainbow trout and Daphnia magna. This will protect fish and other forms of aquatic life.

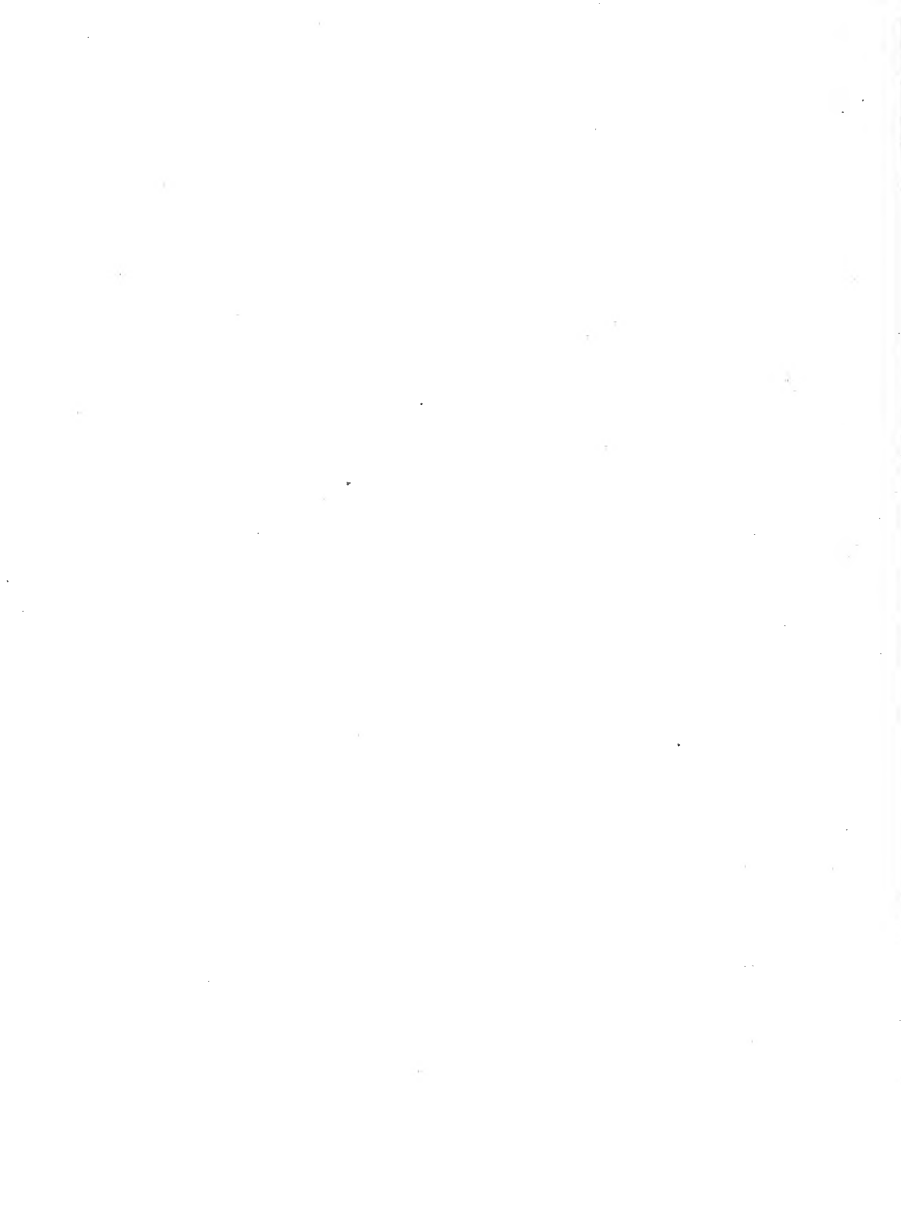
**THE MISA INITIATIVE**

**CHAPTER 1**  
**OF THE**  
**DEVELOPMENT DOCUMENT**



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### 1.1 THE MISA PROGRAM

The MISA program was officially announced by the Ontario Ministry of Environment and Energy in the White Paper of June 1986. MISA is a regulatory program for reducing water pollution from both industrial and municipal dischargers. Initially, technology-based effluent limits will be imposed on each discharger as a minimum pollution control requirement. In addition, more stringent effluent limits can be imposed on dischargers on a site-specific basis to protect local sensitive receiving waterbodies. The ultimate goal of MISA is the virtual elimination of persistent toxic contaminants from all discharges into Ontario's waterways.

The strategy for achieving that goal includes:

- Setting effluent limits for certain sector-specific pollutants
- Ensuring that industrial effluents do not kill fish
- The development of a list of persistent toxic substances for possible ban or phase-out in Ontario
- Requiring industry to reduce those persistent toxic substances that are not specifically slated for ban or phase-out.

The process to develop technology-based effluent limits involves two phases. In the first phase, effluent monitoring regulations are legislated which require dischargers to monitor their point source effluents at regular intervals according to specific sampling, analytical, flow measurement and quality assurance and quality control protocols and procedures. The second phase involves the development and implementation of effluent limits regulations for each of the industrial and municipal sectors, using the data collected under the monitoring regulations.

The Effluent Monitoring Regulations required dischargers to monitor their point source discharges at regular intervals. This monitoring was intended to provide comprehensive data on effluent quality, particularly for toxic contaminants. In order to accurately reflect all discharger operating conditions, the effluent monitoring regulations required sampling at various frequencies over an entire year using specified standard procedures. Industry's self-monitoring under the regulations was subject to independent audits carried out by the Ministry of Environment and Energy.

Information generated by the effluent monitoring regulations produced a database on the contaminants discharged across Ontario. This database is being evaluated and used in the development of effluent limits based on the best available pollution control technology which is economically achievable (BATEA).

The Effluent Limits Regulations are being developed in consultation with different levels of government, industry and the general public. Consultation is facilitated through Joint Technical Committees (JTCs), made up of representatives from the Ministries of the Environment, Natural Resources, Transportation and Northern Development and Mines, Environment Canada, and the affected dischargers. These committees, one per sector, provide an opportunity for the dischargers to have input into the regulation development process.

## 1.2 THE EFFLUENT LIMITS REGULATION DEVELOPMENT PROCESS

The process which was followed in developing the Effluent Limits Regulation for the Industrial Minerals Sector was initially outlined in the MISA White Paper. Each step is briefly described as follows:

### Step 1: Effluent Monitoring

Under the Effluent Monitoring Regulation, direct dischargers were required to monitor for a comprehensive list of contaminants. Up to 150 parameters were monitored on three weekly, weekly, monthly, quarterly, semi-annual and annual basis for process effluent, storm water effluent, minewater effluent and quarry water effluent. The effluent monitoring data were subject to a rigorous data validation exercise in order to confirm the integrity of the information contained in the effluent monitoring database.

### Step 2: Candidate Parameter Selection

Statistical tests were applied to the effluent monitoring data to determine candidate parameters for effluent limits setting. Parameters were not considered if the effluent monitoring data showed (at a 95% confidence level) that a statistical portion of 0.9 of the data were at a concentration of less than the regulation method detection limit.

### Step 3: QA/QC Data Assessment

The quality assurance/quality control (QA/QC) data assessment evaluated the suitability of the effluent monitoring data for use in the effluent limits setting process. Data which were considered unreliable were eliminated from further consideration in the effluent limit setting process.

### Step 4: Best Available Technology Identification

Available pollution control technologies were identified and evaluated. The technologies were screened on the basis of the number, kind, toxicity of the contaminants treated, and the contaminant reductions achieved. Best available technologies were identified and BAT technology train options, representing different levels of pollution control and abatement, were determined. BAT technology train options were reviewed in order to identify the contaminants that would be treated, the costs of each option and the contaminant discharge levels that would result.

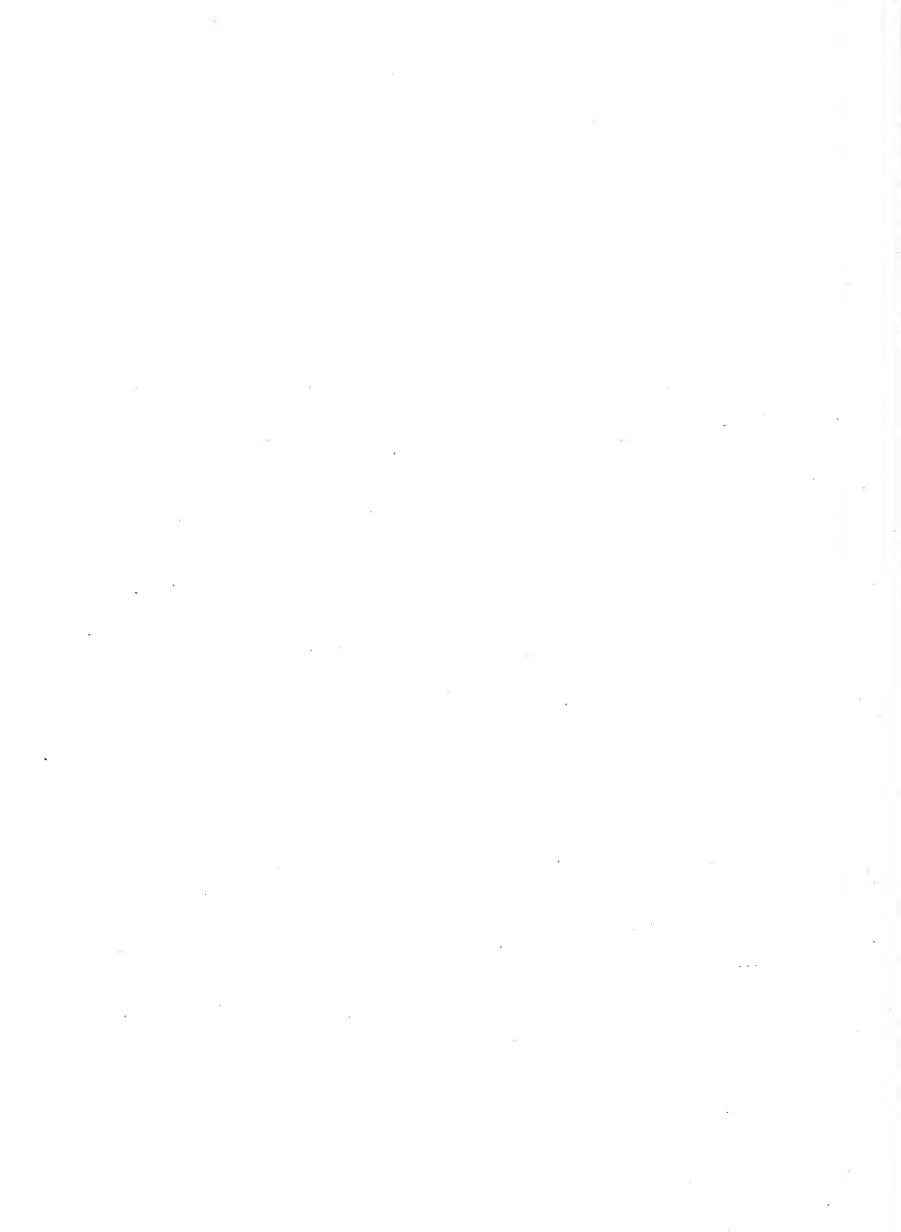
### Step 5: Economic Assessment

Information about estimated pollutant removal efficiencies and the costs of the various BAT technology train options was used to derive abatement cost functions which indicate the relationship between increasingly stringent levels of control and the cost of achieving them. The financial and economic consequences to the Industrial Minerals Sector in Ontario associated with the various levels of control were also estimated.

The information on the identified BAT technology train options and the economic and financial impacts of each option on the sector were used to determine the preferred control option for the Industrial Minerals Sector.

### Step 6: Effluent Limits Setting

Effluent limits were developed based on the identified BAT(EA) and the best professional judgement of the Ministry and Industry as to the contaminants levels that can be achieved by industrial mineral plants in Ontario.



THE INDUSTRIAL SECTOR

CHAPTER 2  
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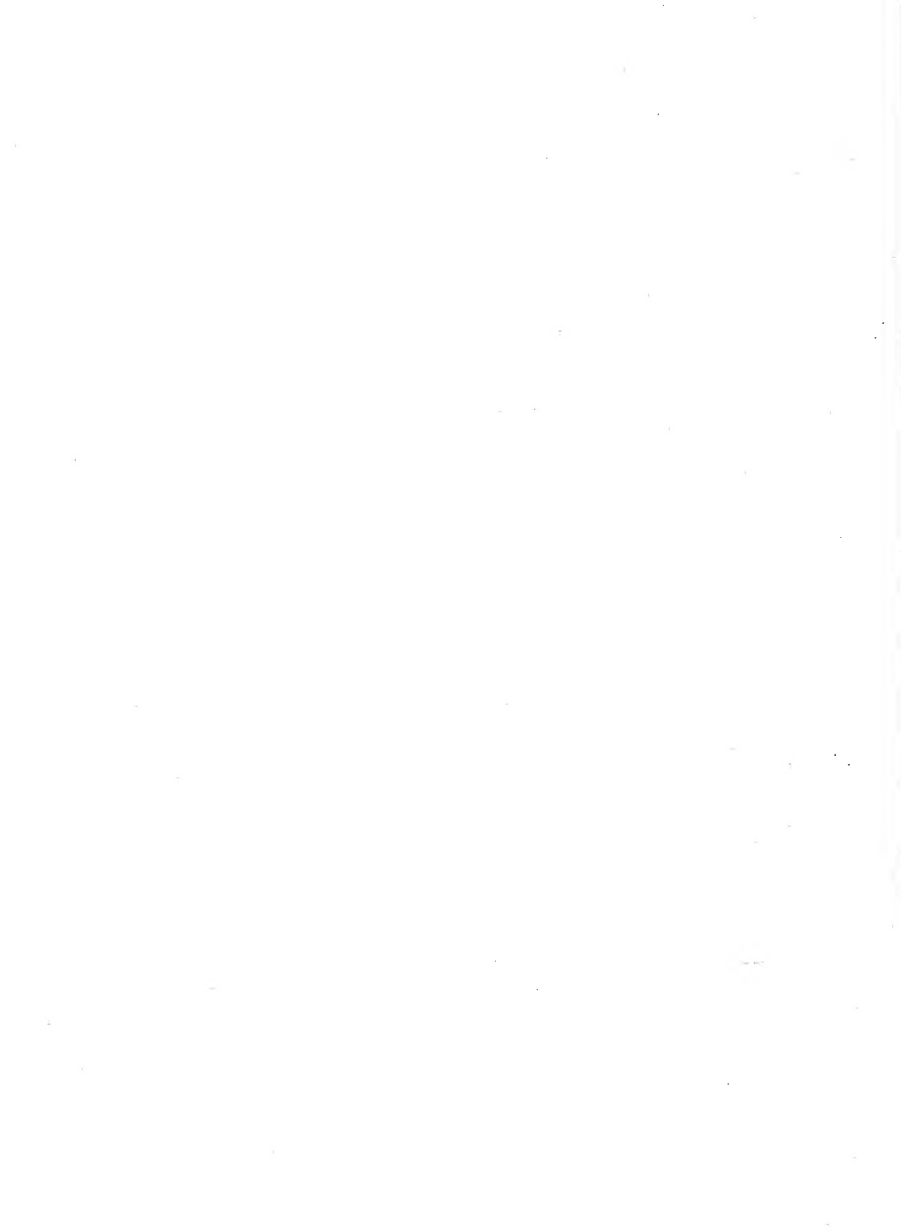


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## 2.1 INDUSTRY PROFILE

The industrial minerals sector is made up of companies that mine and process non-metallic minerals and structural materials. Figure 2.1 lists the 47 companies that participated in the monitoring program and their locations.

Plants in the sector produce a variety of materials including portland cement, lime, gypsum products, talc, graphite, clay brick, roofing granules, magnesium, nepheline syenite, talc, calcite, sand and gravel and crushed stone. The production processes are described below.

## 2.2 PRODUCTION OPERATIONS

### Portland Cement Production

By definition, portland cement consists essentially of hydraulic calcium silicates (tricalcium silicate, dicalcium silicate, tricalcium aluminate and tetracalcium aluminoferrite).

Lime which is the principal raw material is commonly produced from limestone, cement rock, chalk or marl, all of which are primarily calcium carbonate. Cement plants in Ontario are generally situated in areas which contain limestone deposits for easy access to raw materials.

The raw materials used for the production of cement are combined in order to achieve the desired proportions of lime, iron, silica, and alumina components. The remaining ingredients, other than lime, may be obtained from a variety of industrial by-products such as sand, clay, shale, iron ore and blast furnace slag.

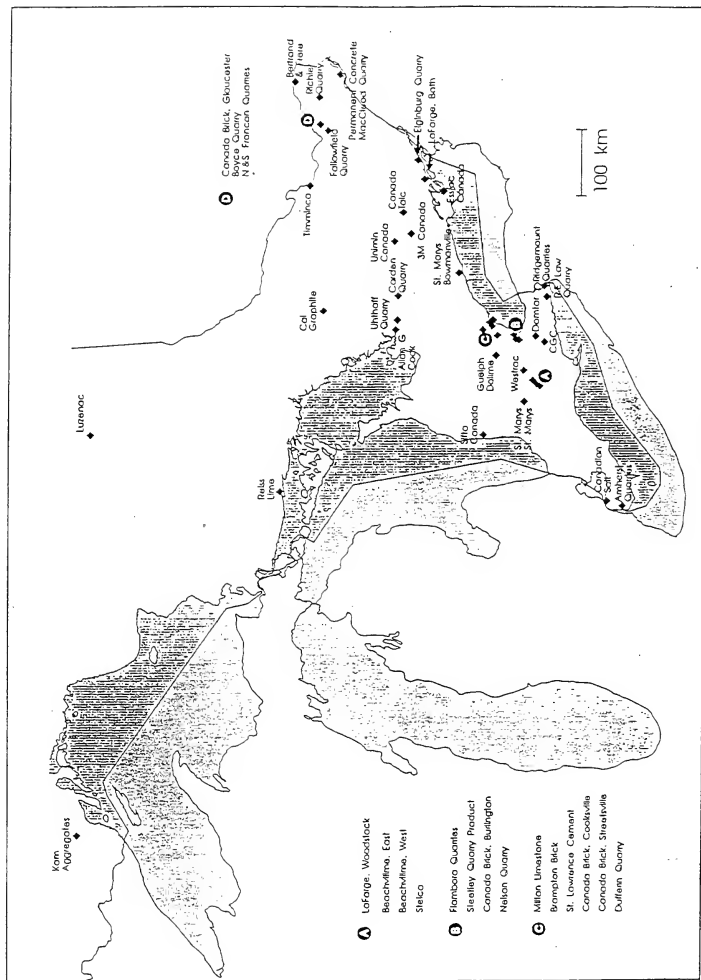
The major steps involved in cement production are;

- comminution and blending of raw materials,
- production of clinker, and
- grinding of clinker.

The raw materials are blended and sometimes ground before use.

Both wet and dry grinding of materials are utilized, thus leading to the two basic processes for cement manufacturing;

FIGURE 2.1: INDUSTRIAL MINERALS SECTOR PLANTS THAT WERE MONITORED



"wet" and "dry". Processing operations using the "dry process" involve grinding, blending and kiln feeding in the dry state. In the "wet process", grinding and blending is achieved in slurry form. At "wet" plants, the finely ground raw materials are stored in slurry tanks. The finely ground dry materials at "dry" plants are stored in silos.

The blended materials are fed into the upper end of a rotary kiln. At temperatures between 400°C and 800°C calcination occurs, converting limestone ( $\text{CaCO}_3$ ) to lime ( $\text{CaO}$ ). Calcium oxide combines with the acidic components of the raw mix at about 1400°C and 1650°C to form calcium silicates, calcium aluminate and calcium aluminoferrite. At 1600°C, the raw materials fuse together to produce hard, marble-sized balls termed clinker. At the discharge end of the kiln, the clinker is rapidly cooled with air.

The water associated with the "wet" processing methods is lost as vapour to the atmosphere during the calcination process in the kilns.

The final cement product is manufactured by pulverizing the clinker. A small amount of gypsum is added during the comminution process. The gypsum is used to control the setting rate of the cement.

The energy produced during grinding is transferred to the cement as heat. The excess heat from the cement is removed by passing the cement through a cooling jacket. Water is used as the indirect cooling medium which is circulated through the jacket or across the heat exchange surface.

Pneumatic pumps are used to transport the finely ground cement within the plant. The air supply for pneumatic operation is provided by water cooled compressors. Dry grinding and pneumatic pumping are major sources of dust problems at cement plants.

### Lime Production

Quarried limestone (impure calcium carbonate) is the raw material for the production of chemical lime.

Chemical lime production involves the following operations;

- primary crushing,
- conveying,
- classification, and
- calcination.

Primary crushing of limestone is carried out using jaw or gyratory crushers. Grizzlies (screens) are also optionally employed to remove undersized stone. Some plants utilize secondary crushing to make by-product stone saleable.

Rubber belt conveyors are generally used to convey crushed stone to the processing plant. Screens are used to obtain various size fractions of material for further processing or as final product for sale.

In order to achieve calcination, the raw material is fed into the upper end of a kiln, and then passes through the kiln at a rate controlled by the slope and the rotational speed. Burned fuel (powdered coal, petroleum coke, fuel oil, or gas) is forced into the lower end of the kiln where it produces temperatures of 400°C to 800°C for calcination. The carbon dioxide gas that is evolved is removed and cleaned using electrostatic precipitators or wet scrubbers.

The resulting product is cooled, and it may then be classified, hydrated, transferred to storage or packaging facilities, or it may be loaded onto bulk carriers for shipment.

#### Clay and Shale Production

Clay is a natural material composed of very fine grades of minerals that are essentially hydrous aluminum silicates or occasionally hydrous magnesium silicates with plastic properties. Shale is a laminated sediment in which the constituent particles are predominantly of the clay grade.

Two types of shales are currently used in Ontario; the red Queenston shales and the Georgian Bay grey shales.

The Clay & Shale category includes brick manufacturing plants in the province. Brick technology is divided into four main process stages which cover;

- mining and processing of raw materials,
- shaping and forming,
- drying and firing, and
- inspection and packaging.

Shale and Clay are mined in open pits using rippers, scrapers, bulldozers and front-end loaders. Blasting and drilling are rarely used. The excavated material is then loaded on trucks and sent to the processing plant.

Comminution is achieved through the use of a primary crusher and pan mill grinder. This is followed by classification of the ground product using a series of screen decks. The oversize material is returned to the pan mill and the finished products are delivered to extrusion machines where bricks are formed. The bricks are dried, fired, inspected and shipped to customers.

Since excess water is collected only during the mining and processing stage, other aspects of brick manufacturing technology will not be reviewed. Even in the mining of shale and clay, there is no direct use of water for industrial operations. Only rainfall and groundwater seepage into pits result in the need for pit dewatering. Water collects within the pits due to the impermeability of the clay surface.

### Graphite Production

Graphite is a naturally occurring mineral form of elemental carbon. It is typically found in veins, isolated pockets or as flakes within the host rock. Minerals associated with the occurrence of graphite include feldspar, quartz, mica, pyroxene, zircon, and iron sulphides.

In Ontario, the ore is mined using open pit methods. Following the excavation stage which includes drilling and blasting, the broken ore is transported by truck to the plant where it undergoes crushing and grinding.

Milling is used to release the graphite flakes from the waste rock. Since graphite floats, flotation is used as the separation process for producing a graphite concentrate. PH adjustment or the addition of various reagents (e.g. kerosene) may be used to enhance flotation. The graphite concentrate is floated, thickened, filtered and dried. The slurried waste rock is discharged to a tailings pond.

Some of the water from the tailings pond may be recycled back to the plant following treatment by sedimentation.

### Gypsum Production

Gypsum (hydrated calcium sulphate), is extracted from sedimentary deposits in Ontario using the room-and-pillar method. The ore is then calcined for the production of gypsum products.

The processing steps associated with gypsum production include;

- primary crushing,
- conveying,

- secondary crushing,
- classification,
- calcination, and
- grinding.

Primary and secondary crushing is achieved at most mines using gyratory and jaw crushers, or impact mills. The ore is transported from the underground mine to a surface milling plant using skips or belt conveyors, where it may undergo secondary crushing. At one of the Ontario plants, heavy media separation, using ferro-silicon as the medium, is employed for the removal of impurities from the ore.

During the calcination process which takes place in rotary kilns or kettles, approximately 75% of the water of hydration is driven off. The process usually takes approximately 2-3 hours during constant agitation at a temperature between 121 and 150°C. The final product is in a hemi-hydrated form and is commonly known as plaster of paris.

The calcined gypsum undergoes final grinding normally by either hammer-mills or roller mills. Screens and cyclone-type particle collectors are arranged in a closed-circuit configuration for recycle of the dust. Crushing areas are generally equipped with dust control and ventilation systems to eliminate dust problems. The final product is used in the manufacture of gypsum plasters and wallboards.

#### Magnesium Production

There is only one plant in Ontario currently producing magnesium metal. The plant uses dolomite (calcium-magnesium carbonate) as the principal raw material. The production steps may be summarized as follows;

- surface mining of dolomite,
- primary and secondary crushing (gyratory or jaw crushers),
- calcination,
- grinding (roller mill),
- mixing,
- briquetting, and
- thermal reduction.

The dolomite is quarried using conventional open pit mining techniques. This is followed by primary and secondary crushing. Calcination takes place in rotary kilns. Here, the dolomite is converted to  $MgO \cdot CaO$ . Finely ground ferrosilicon is mixed with the calcined dolomite. Hard dense briquettes are produced with a briquetting machine.

Thermal reduction is completed under vacuum and high temperature conditions to produce magnesium metal.

#### Crushed Stone Production (Quarries)

Types of equipment similar to those for sand and gravel production are used for limestone operations. Also included are the additional steps of blasting and heavy crushing.

Production of crushed stone obtained by quarrying involves the following steps;

- removal of overburden,
- drilling, blasting,
- loading and hauling of loosened material,
- crushing
- screening (classification)
- washing (in some cases), and
- stockpiling and delivery.

#### Sand and Gravel Production

Two types of product are available on the market - processed or unprocessed sand and gravel.

Many producers of sand and gravel do not process the raw materials. After the removal of overburden, material is excavated, loaded, and is then delivered to the customer.

The production of processed sand and gravel involves the following operations, or combinations thereof;

- removal of overburden,
- excavation of material,
- haulage,
- primary classification,

- primary and secondary crushing, and
- secondary classification.

The material is excavated using front-end loaders, power shovels, dragline, bulldozer, or any other earth-moving equipment. It is hauled on-site by truck or conveyor to the processing plant where it is subjected to primary classification using inclined vibrating or rotating screens. The larger aggregates may be subjected to further crushing with jaw, gyrating, roller, cone, or impact crushers.

Secondary classification of the final sized products is obtained through screening and dewatering.

The processed material is delivered or stockpiled. Stockpiling is implemented to overcome variations in process operations (e.g. seasonal processes or operations such as washing) and fluctuations in product demand.

### Talc Production

Talc is a soft, hydrous magnesium silicate mineral. In Ontario, it is obtained by either underground or surface mining. Talc processing may vary from simple dry grinding to more complex techniques such as flotation.

Processing steps at Ontario talc mines producing high purity talc include;

- primary crushing (jaw or impact crushers),
- screening,
- secondary crushing (impact or cone crusher),
- drying, and
- fine grinding (roller mills and high speed hammer mills).

As a result of the dry grinding process, dust is generated; thus developing a need for dust control equipment.

Talc deposits which are impure, such as talc magnesite or talc-dolomite, require different processing methods because of the need for raw material purification. After primary and secondary crushing, the rock is ground in ball or roller mills. Separation of these mixtures may be achieved by froth flotation since the talc has a tendency to float from the impurities. Magnetic separation is used to further purify the talc. The talc slurry is then filtered, dried and may be further ground depending on its particle size.

### Salt Production

In Ontario, salt (halite or sodium chloride) is recovered from underground salt deposits by two main methods depending on what the final product is to be used for. Salt for ice control and for some industrial uses is usually mined by sinking a shaft into the desired salt bed. A technique known as the "room and pillar" method is commonly used to recover salt. In this method, rooms are excavated and machinery such as crawler-mounted undercutters are used to undercut the face to a dept of about 10 ft. The salt face above the undercut is drilled to a dept of about 10 ft. Holes are evenly spaced across the full width and dept of the face, lightly loaded with explosives and blasted. The blast reduces most of the salt to easily manageable sizes. Shuttle cars carry the salt to the primary crushing station where it is reduced in size to about 6 inches. The secondary crushing may take place underground or the salt may be elevated to the surface following primary crushing.

The mined salt is packaged into bags or stockpiled. Airborne dust generated during packaging operations is collected with a wet dust scrubber by dissolving the salt in water. The scrubber effluent contains high levels of dissolved salt.

High purity salt for human consumption and food processing is produced from concentrated salt solution, usually called brine, by "solution mining". The brine is produced by sinking a well into the salt deposit and pumping water into the well to dissolve the salt. The brine is then brought to the surface and evaporated in multi-effect evaporators to produce highly purified granular salt of various particle sizes.

### 2.3 WATER USE AND WASTEWATER SOURCES

The common sources of wastewater at industrial minerals plants are:

- the mine and its associated facilities, and
- manufacturing facilities.

The mining operation typically requires dewatering in order to permit further extraction and excavation activities. Water collects in the pits or mines as a result of groundwater seepage, precipitation and storm run-off. As a result of the excavation and comminution equipment, the creation and dispersion of particulate matter affects the quality of the water primarily with respect to suspended solids content. Due to the operation and maintenance of heavy equipment, oil and grease may be a potential contaminant.

The manufacturing facilities are generally involved in production processes which do not substantially modify the

chemistry of the initial raw materials. The purpose of the heating and mixing processes carried out in kilns are generally intended to remove the water of crystallization and carbon dioxide, and to promote solid state reactions. The primary function of water usage in these facilities is non-contact cooling water and dust suppression.

The sources of wastewater in the various categories are described below.

#### Cement Plant Effluent

The operations where the largest volumes of water are used in cement plants are essentially non-polluting. Process water in wet plants is evaporated. The major use of water at most cement plants is for cooling. This water is used to cool bearings on the kiln and grinding equipment, air compressors, burner pipes and the cooling of cement prior to storage or shipment.

While cooling water is mostly non-contact, it can become contaminated to some extent through poor water management practices. This contamination may include oil and grease, suspended solids, and even some dissolved solids. If cooling towers are used, blowdown discharges may contain residual aldehydes.

All cement plants have some accumulation of settled dust on the plant property and this dust may show up in the wastewater in a number of ways. Many plants spray water on the roads to prevent the dust from becoming airborne by truck traffic. Most plants also routinely wash accumulated dust off the trucks. The amount of water used for these purposes varies widely. Some of this water inevitably evaporates, but depending on the topography of the site, some of this water may drain into storm sewers or natural waterways.

Water from surface run-off after rain may also be laden with the dust that accumulates on the plant site. Run-off from dust piles, coal piles, and raw material piles may also become contaminated. Plants with boilers, cooling towers, and intake water-treatment facilities, have blowdown and backwash discharges associated with these operations.

At some plants, raw materials are washed and at others the raw materials are enriched by a beneficiation process. These processes may result in wastewater discharges containing suspended solids.

Where an active or abandoned quarry is used as a receiving basin for dust disposal or plant wastewater, the discharge from the quarry may be contaminated with wastes associated with cement manufacturing.

### Lime Plant Effluent

In general, lime plants have limestone quarries on site and their main source of water is the quarry water. In one particular case, limestone is shipped across the Great Lakes to the plant site.

Water is used mainly for cooling kiln bearings at all the plants. Though the cooling water is mainly non-contact, it may become contaminated with oil, grease and dust from the operation of heavy machinery and equipment.

Two methods are used to control dust from kiln gases before they are discharged to the atmosphere - electrostatic precipitation and wet scrubbing.

Wet scrubbers constitute a major portion of water usage at some plants. Plants that use wet scrubbers employ turbulent contact absorption of the carbon dioxide evolved during the calcination process. This practice neutralizes the otherwise highly alkaline scrubber effluent.

### Graphite Plant Effluent

The sources of wastewater from the mining and beneficiation of graphite ore include:

- water which collects in the quarry (quarry water effluent);
- water used at the plant site (graphite plant effluent); which is comprised of (1) water used for slurring the milled ore to effect separation by flotation; as well as, (2) non-contact cooling water for plant equipment (i.e. milling equipment, compressors, vacuum pumps), and
- storm run-off from waste rock piles (storm water effluent);

The graphite plant effluent is routed to what is known as a tailings pond for treatment prior to being released. This also may include water which is pumped from the quarry during dewatering.

Since the ores from this category may be acid-producing, the tailings pond may serve as a neutralization basin (through the addition of limestone), in addition to a sedimentation pond.

### Gypsum Plant Effluent

Water usage in the production of gypsum involves the following operations, depending on the plant:

- primary and secondary crushing;
- screening and washing;
- heavy media separation (sink and float);
- washing;
- processing of "float" gypsum; and
- stockpiling of "sink" dolomitic limestone.

Crushing usually takes place in the mine and grinding at the mill. One of the uses of water includes non-contact cooling water for the comminution equipment.

One plant uses heavy media separation (sink and float) to beneficiate impure gypsum prior to processing. Magnetite and ferro-silicon are used as the separation media, with recycle of the media.

In the manufacturing plant, a complete range of gypsum plasters and wall boards are produced. Water is driven off as steam during calcination in the kilns or during wall board drying in the ovens.

Gypsum plant effluent is made up of wastewater from the mill and run-off from the plant site.

### Magnesium Plant Effluent

There are three main areas where water is used and/or produced at a magnesium metal plant site. These include the quarry, the calcination plant and the reduction plant.

The quarry is dewatered to prevent flooding due to ground water seepage and storm events. The mining practices conform with conventional surface mining and thus may be classified as quarry water effluent.

The water usage at the calcination and reduction areas is primarily non-contact cooling water for manufacturing equipment. This water is released through open channels and may be considered as potentially contaminated cooling water. It is classified as Magnesium Plant Effluent.

### Minewater Effluent

Minewater is primarily the result of natural surface water that percolates into underground mine workings or condensate from ventilation air. In addition to natural water influents, water is pumped underground for mining purposes. For instance, water is used underground for drilling, dust suppression, pumping, cooling and sanitation.

The natural water that percolates into an underground mine and the water that is deliberately pumped underground for process use comes into contact with the mineralized rock. This water must be removed from the mine to prevent flooding. The water is therefore collected in one or more sumps and is pumped to the surface. This water, while it is resident in the mine, is contaminated by the mining process itself. It may contain quantities of mine-machinery lubricants, trace quantities of various explosives, rock-fines, mine-water treatment chemicals, and traces of all the chemical materials that are used in and around the mine.

Minewater effluent from underground rock-salt mining operations are discussed under "Effluents from Salt Mines".

### Quarry Water Effluent

Mineral aggregate mining operations require adequate sources of water for use in many stages of processing. Water may be used for the separation of materials, to settle dust, and for cleaning the final product. Non-potable water is acceptable for any of these purposes and water obtained from wells, surface run-off or any accessible groundwater may be used.

Many plants develop their own water supply on site through excavation of aggregate deposits which lie below the water table. Water is usually recycled to storage or settling ponds and occasionally will be discharged to surface watercourses after settling.

As some sand and gravel pits and limestone quarries operate below the water table, extensive dewatering of the site is carried out continuously or intermittently to prevent flooding of working areas.

### Washwater Effluent (pits and quarries)

Aggregates for use in the construction industry are made available as washed product. This includes sand and gravel recovered from pits, as well as crushed stone from quarries.

The washing operation generally involves the use of vibrating or rotating screens and water to clean the aggregates. Any accessible ground water or surface run-off may be used for washing. As a common practice, the wash water is discharged to a series of settling ponds and the clarified water is reused.

Washing is the only significant use of water at sand and gravel sites. Most of the sand and gravel sites employ 100% recycle of their wash water. Additionally, some wash water and surface run-off penetrates through the porous sand and gravel beds and re-enters the ground water system. Subsequently, a very small percentage of the Sand and Gravel sites discharge wash water effluent to surface waters. In the case of quarries, excess water may result from washing operations since water drainage is limited due to impervious ground conditions.

In general, wash water effluents are made up of wastewater from washing operations and may include a combination of excess ground water and surface run-off.

#### Storm Water Effluent (run-off)

Typically, plants in the sector do not have a separate collecting system for storm water. Consequently storm water is usually included as a component of one of the other effluent streams.

Rain and snow fall directly into open pits and quarries. In the case of most gravel pits, this source of water disappears into the groundwater system or evaporates. Clay and shale pits, and quarries are mostly impermeable, thus mine dewatering after storm events (rainfall and spring thaw) is extensively practised. In the salt category, one company, The Canadian Salt Co., stores large quantities of crushed salt in open piles. Storm runoff from these storage piles is saturated with salt and creates a pollution concern. Sifto Canada Inc., the other company in the salt category, is able to store some salt inventory underground in excavated salt caverns, thereby reducing this problem.

#### Process Effluent

Process effluent includes effluent that originates from or comes into contact by design with any industrial process or process materials, and includes continuous and intermittent discharges, blowdown from recirculating cooling water systems, and wastewaters discharged during a maintenance shut-down period for all or part of the plant.

## EFFLUENTS FROM SALT MINES

### Effluents from Underground Rock-Salt Mining:

Rock salt mining is essentially a dry operation; however, some water does enter the mine from shaft leakage or water vapour condensation. This minewater is high in dissolved salt. Some of this water is used for underground dust control while excess is pumped to the surface for discharge. Water is also pumped underground for drinking, sanitary use and equipment washing. Wastewater is pumped to surface for discharge.

Airborne dust generated during the crushing, stockpiling and packaging operations is collected with a wet dust scrubber by dissolving the salt in water. The scrubber effluent contains high levels of dissolved salt.

### Effluents From Solution Mining:

The method of solution mining involves pumping a large quantity of water underground to dissolve salt and withdrawing a saturated brine solution. The salt is then recovered by evaporating the water in "open-pan" evaporators. The main waste streams from solution mining operations are the condenser cooling water and the evaporator condensate streams from the evaporation step.

Salt slurry removed from the evaporators is then filtered and further dried by a rotary drier or heated screw conveyor. Salt dust in the exhaust air from the dryers is removed by a wet scrubber which produces an effluent containing elevated levels of dissolved solids.

Other sources of wastewater from solution mining include bleeds and washing from the evaporators, brine spills, overflows and tank bottoms.

## 2.4 WASTEWATER TREATMENT

Wastewater treatment using sedimentation ponds for suspended solids control is the standard practice for the Industrial Minerals Sector. Often, a series of ponds is used, with the first pond (primary settling) collecting the heavy load of easily settled material and the other ponds (secondary, tertiary) providing additional solids removal to achieve the desired suspended solids level. As the ponds fill with solids, they can be dug out or dredged to remove these solids or they may be left filled and new ponds installed.

The volume of wastewater produced by the Industrial Minerals Sector may be reduced primarily through recycling of water. Recycling of water is widely practised, mainly by aggregate producing plants in this sector. Most sand and gravel pits with washing facilities have attained zero effluent discharge due to recycling.

The manufacturing plants also have the opportunity to reduce effluent discharge by recycle of cooling water. 100% recycle of cooling water has been implemented at one cement plant.

In some gypsum plants a portion of the minewater from gypsum mines is used as intake water for the processing plant. This water is subsequently lost through evaporation during the production of gypsum wallboard.

With respect to mining operations, groundwater seepage into mines and pits may be reduced through the application of periphery wells. Water may be pumped from wells which are installed in appropriate locations surrounding the mining site. This technique is used as a means of intercepting groundwater seepage into the mine, and thus preventing contamination of those waters on the site.

Materials mined and processed in this sector are generally alkaline and non-acid producing. In the case of manufacturing lime from limestone or dolomite, high alkaline effluents could be produced. Alkalinity is controlled by use of in-situ production of carbonic acid (a by-product of the calcination process) or by adding purchased sulphuric acid.

THE EFFLUENT MONITORING DATABASE

CHAPTER 3  
OF THE  
DEVELOPMENT DOCUMENT



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### 3.0 WASTE CHARACTERIZATION INFORMATION DATABASE

This chapter presents information about the sources of data on pollutants discharged by the Industrial Minerals Sector. These data were used in developing the effluent limits regulation. The sources include:

- Pre-regulation Monitoring
- MISA Effluent Monitoring
- Other Sources

#### 3.1 PRE-REGULATION MONITORING

The purpose of the pre-regulation monitoring program was to generate current data on the presence or absence of conventional and EMPPL (effluent monitoring priority pollutant list) parameters in effluents typical of the sector and to aid in assigning appropriate monitoring frequencies in the effluent monitoring regulation.

Based on the results of the pre-regulation monitoring a sector parameter list was developed. The sector parameter list is shown in Table 3.1.

Table 3.1  
Monitoring Parameter List, Industrial Minerals Sector

ATG	Name	Parameter
1	Chemical Oxygen Demand	Chemical Oxygen Demand (COD)
2	Total Cyanide	Total Cyanide
2A	Weak Acid Dissociable Cyanide	Free Cyanide
3	Hydrogen Ion (pH)	Hydrogen Ion (pH)
4a	Nitrogen	Ammonia plus Ammonium
4b		Total Kjeldahl Nitrogen (TKN) Nitrate plus Nitrite
5a	Organic Carbon	Dissolved Organic Carbon (DOC)
5b		Total Organic Carbon (TOC)
6	Total Phosphorus	Total Phosphorus
7	Specific Conductance	Specific Conductance
8	Suspended Solids	Total Suspended Solids (TSS) Volatile Suspended Solids (VSS)
8A	Dissolved Solids	Dissolved Solids
9	Total Metals	Aluminum Beryllium Cadmium Total Chromium Cobalt Copper Lead Molybdenum Nickel Silver Thallium Vanadium Zinc
10	Hydrides	Antimony Arsenic Selenium
11	Chromium (Hexavalent)	Chromium (Hexavalent)
12	Mercury	Mercury
14	Phenolics (4AAP)	Phenolics (4AAP)
15	Sulphide	Sulphide

Table 3.1 (cont.)  
Monitoring Parameter List, Industrial Minerals Sector

ATG	Name	Parameter
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethylene 1,2-Dichlorobenzene 1,2-Dichloroethane 1,2-Dichloropropane 1,3-Dichlorobenzene 1,4-Dichlorobenzene Bromoform Bromomethane Carbon Tetrachloride Chlorobenzene Chloroform Chloromethane Cis-1,3-Dichloropropylene Dibromochloromethane Ethylene Dibromide Methylene Chloride Tetrachloroethylene Trans-1,2-Dichloroethylene Trans-1,3-Dichloropropylene Trichloroethylene Trichlorofluoromethane Vinyl Chloride
17	Volatiles, Non-Halogenated	Benzene Styrene Toluene o-Xylene m-Xylene and p-Xylene
18	Volatiles, Water Soluble	Acrolein Acrylonitrile
19	Extractables, Base Neutral	Acenaphthene 5-Nitro Acenaphthene Acenaphthylene Anthracene Benz(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoroanthene

Table 3.1 (cont.)  
Monitoring Parameter List, Industrial Minerals Sector

ATG	Name	Parameter
19	Extractables, Base Neutral	Biphenyl Camphene 1-Chloronaphthalene 2-Chloronaphthalene Chrysene Dibenz(a,h)anthracene Fluoranthene Fluorene Indeno(1,2,3-cd)pyrene Indole 1-Methylnaphthalene 2-Methylnaphthalene Naphthalene Perylene Phenanthrene Pyrene Benzyl Butyl Phthalate Bis(2-ethylhexyl) Phthalate Di-n-butyl Phthalate 4-Bromophenyl Phenyl Ether 4-Chlorophenyl Phenyl Ether Bis(2-chloroisopropyl)ether Bis(2-chloroethyl)ether Diphenyl Ether 2,4-Dinitrotoluene 2,6-Dinitrotoluene Bis(2-chloroethoxy)methane Diphenylamine N-Nitrosodiphenylamine N-Nitrosodi-n-propylamine
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol 2,3,4,6-Tetrachlorophenol 2,3,5,6-Tetrachlorophenol 2,3,4-Trichlorophenol 2,3,5-Trichlorophenol 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol 2,4-Dimethyl Phenol 2,4-Dinitrophenol 2,4-Dichlorophenol

Table 3.1 (cont.)  
Monitoring Parameter List, Industrial Minerals Sector

ATG	Name	Parameter
20	Extractables, Acid (Phenolics)	2,6-Dichlorophenol 4,6-Dinitro-o-cresol 2-Chlorophenol 4-Chloro-3-methylphenol 4-Nitrophenol m-Cresol o-Cresol p-Cresol Pentachlorophenol Phenol
24	Chlorinated Dibenzo-p-dioxins	2,3,7,8-Tetrachlorodibenzo-p-dioxin Octachlorodibenzo-p-dioxin Octachlorodibenzofuran Total Heptachlorinated Dibenzo-p-dioxins Total Heptachlorinated Dibenzofurans Total Hexachlorinated Dibenzo-p-dioxins Total Hexachlorinated Dibenzofurans Total Pentachlorinated Dibenzo-p-dioxins Total Pentachlorinated Dibenzofurans Total Tetrachlorinated Dibenzo-p-dioxins Total Tetrachlorinated Dibenzofurans
25	Solvent Extractables	Oil and Grease
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)
30	Anions	Chloride Fluoride Sulphate
32	Fibrous Chrysotile Asbestos	Fibrous Chrysotile Asbestos

### 3.2 MISA EFFLUENT MONITORING

Based on the information collected during pre-regulation monitoring and other available information about chemicals likely to be present in sector effluents, category specific monitoring schedules were developed with each parameter from the effluent monitoring priority pollutant list (EMPPL) assigned one of the following frequencies:

Routine Monitoring:	Thrice-weekly
	Weekly
	Monthly

Characterization Monitoring: Quarterly  
Semi-annual  
Annual

In general, parameters which were previously found or expected to be present in category effluents and, therefore, the most likely candidates for limits, were monitored on a "routine" basis. Characterization monitoring consisted of infrequent analysis for the complete EMPPL list at one of the above "characterization" frequencies depending on the category. The companies were also required to conduct a quality control program to insure the monitoring data could be proven reliable. In addition to chemical analysis, companies were required to measure wastewater flow to an accuracy of 20% percent and also conduct acute toxicity testing on two species; rainbow trout and *Daphnia magna*.

The details of the development of the Industrial Minerals monitoring regulations are contained in "The Development Document for the Effluent Monitoring Regulation for the Industrial Minerals Sector"<sup>1</sup>. The monitoring regulation for the salt category was developed separately from the other Industrial Minerals categories and is contained in the "The Development Document for the Effluent Monitoring Regulation for the Ontario Mineral Industry Sector: Group A"<sup>2</sup>. The salt category was transferred to the Industrial Minerals Sector in March, 1992 for the limit setting phase of the MISA program.

The effluent monitoring data for the Industrial Minerals Sector were collected under Ontario regulation 91/90 over the period August 1, 1990 to July 31, 1991. The salt plants monitored over the period February 1, 1990 to January 31, 1991 under the Metal and Salt Mining Effluent Monitoring Regulation (Ontario Regulation 481/89 as amended to Ontario Regulation 44/90).

During the MISA monitoring period, data were collected by industry according to Ministry specifications described in the above regulations.

Each company reported its monitoring data to the Regional Ministry Office in electronic form using the MISA Data Entry System (MIDES). After checking for completeness by Regional staff, the data were transferred to the Ministry's central Sample Information System where it could be assessed as a complete data set for analysis.

### 3.2.1 Data Validation

Before using any data for limit setting or public reporting it was necessary to confirm the integrity of the information contained in the database. Data entry errors would adversely affect any calculations performed with the data. In order to

verify proper reporting by all companies the following checks were performed:

#### Units Verification

Data were inspected to insure that the correct units were reported for each parameter for the entire monitoring period. The use of data with incorrect units would produce large errors in any calculations performed. A number of unit entry errors were found and corrected.

#### Multiple Record Check

Data were checked for multiple records, that is if two or more records existed for the same control point, parameter and day. A small number of multiple entries were found in the database. In all cases the multiple results were very similar or identical for the same parameter on the same day; therefore, all multiple records were averaged prior to any subsequent data analysis.

#### Outlier Investigation

Statistical outliers were identified according to the procedures outlined in the Issues Resolution Committee's Draft Reports<sup>3</sup>. Outlier values were examined to insure correctness. A number of outliers determined to be entry errors were excluded from further data calculations.

#### Review of Remark Coded Data

The system of data entry (MIDES) allowed each data entry to be qualified with a remark code from a list of twenty-nine codes established by the Ministry. Remark codes were used to highlight any concerns the analyst may have had with individual data entries. Table 3.2 lists the remark codes used to qualify monitoring data in the Industrial Minerals Sector database and the number of data points associated with each code.

Data with each remark code were reviewed in comparison to other results reported for a parameter in order to identify data which obviously should be excluded. Only data with the code 'UCR' were excluded from further data analysis. Data entries with a < <DL <T or <WE code and a value less than 1/10 RMDL were substituted with 1/10 RMDL. Zero values with other codes were excluded. Non-zero data with other codes and a value less than 1/10 RMDL were substituted with 1/10 RMDL.

Table 3.3 lists the number of data points remaining for each remark code after the database was screened according to the above remark code procedure.

TABLE 3.2  
Remark Codes  
Associated with Concentration Data

Remark Code	Description	Number of Data Points
	No remark code	15888
<	Actual amount less than reported	86
<DL	Reported value = MDL: measured amt. MDL (non-zero)	16230
<WE	No measurable response (diln/conc): reported value	5
A	Approximate value	1
AIS	Approximate value	2
AR	Attached report	127
IM	Interference matrix	3
N/A	No data will be reported	698
OLD	Old: samples exceeds maximum storage time	68
SIP	Sample improperly preserved	6
?	Late data: data not yet available: see text	3
IN	No data: insufficient volume due to inspection	10
NM	No effluent - no sample will be reported	1507

TABLE 3.3  
Number of Data Points Used in Concentration Data Summaries

Remark Code	Number of Data Points	% of Total
No remark	15410	48.59
<	81	.25
<DL	16031	50.55
<WE	5	.02
A	1	<.01
AIS	1	<.01
AR	111	.35
IM	3	.01
OLD	66	.21
SIP	6	.02
Total	31715	100.0

### 3.2.2 Selection of Candidate Parameters for Limit Setting

A large quantity of data were generated by the effluent monitoring regulation. Parameters were listed as selected unless a proportion of 0.9 of the concentration results had values less than the regulation method detection limit (RMDL) at 95% confidence level. For the Industrial Minerals Sector 40 candidate parameters were selected according to the above statistical procedure.

### 3.2.3 QA/QC Analysis of Monitoring Data

To insure that the sampling and analytical data were of reliable quality a detailed quality assurance and quality control assessment was then performed on data for the selected candidate parameters. Use of data of an unknown or unreliable quality could lead to limits that are too stringent or too lenient or reporting of improper results to the public. Details of the QA/QC assessment are published in the 12-month report for the Industrial Minerals Sector<sup>4</sup>.

Based on the QA/QC assessment, 6 parameters (Table 3.4) were found to have unreliable data and eliminated from consideration for limits in the sector. Table 3.5 lists the parameters and the number of effluent streams in which each parameter was found for the Industrial Minerals Sector which have acceptable data after the QA/QC assessment.

TABLE 3.4  
Parameters Rejected Based on Assessment  
of QA/QC Data Listed According to Type of Monitoring  
(Numbers indicate Number of Effluent Streams Found to Have Unacceptable Data for a Parameter)

ATG	Parameter	Routine Monitoring	Characterization Monitoring	Storm Water Monitoring
1	COD		4	
2B	Cyanate		1	
2C	Thiocyanate		2	
10	Antimony		2	
16	1,2-Dichloroethane		1	
20	4-Nitrophenol		4	

### 3.2.4      Results of Monitoring

#### Concentration Data

A summary of the monitoring results are presented in Appendix III. Sixty-eight effluent streams were monitored at forty-seven plant sites. The long term average concentration of all found parameters at each plant are listed by effluent types. The RMDL of the parameters, the total number of samples taken and the samples that had values greater than the RMDL are also indicated.

Detailed information on the monitoring data can be obtained in the Twelve Month Monitoring Data Report, Industrial Minerals Sector<sup>4</sup>.

#### Toxicity Testing

Acute toxicity testing occurred at 46 sites instead of 47 sites due to one plant closure. For 4 sites, samples were consistently lethal to one or both test animals (ie. Rainbow Trout and *Daphnia magna*). The 4 sites were; Sifto Canada Inc. in Goderich, The Canadian Salt Company, Windsor, Reiss Lime Company of Canada Ltd., Spragge and Beachville, East plant, in Beachville.

For 7 sites, samples were sometimes lethal to one or both test animals. These sites were; Essroc Canada Inc., Picton, Lafarge Canada Inc., Bath, St. Marys Cement Corporation in St. Marys and Bowmanville, Unimin Canada Ltd., Nephton, Domtar Inc., Caledonia and CGC Inc. in Hagersville.

**TABLE 3.5**  
**Parameters with Acceptable Data Listed According to Number of**  
**Effluent Streams Where a Parameters was Found.**

ATG	Parameter	Routine Monitoring	Characterization Monitoring	Storm Water Monitoring
2	Cyanide Total	1	3	1
6	Total Phosphorus	3	3	
8	Total suspended Solids	52		10
9	Aluminum		23	5
	Cadmium	2		
	Cobalt		2	
	Copper	2		
	Molybdenum			2
	Nickel		3	
	Vanadium		2	
	Zinc	1	14	3
10	Arsenic	3		
14	Phenolics (4AAP)	22	1	1
15	Sulphide		10	4
17	Toluene		1	
19	Di-n-butyl phthalate		2	
	Phenanthrene		1	
20	2,4-Dimethylphenol	1		
	Pentachlorophenol		1	
	Phenol	1		
	m-Cresol	1		
	o-Cresol	1		
	p-Cresol	1		
25	Oil and Grease	40		4
4	Ammonia plus Ammonium	24	1	1
	Total Kjeldahl Nitrogen	5		
	Nitrate + Nitrite	4	23	8
5	DOC		31	5
	TOC		2	
30	Chlorides	11	17	3
30	Fluoride			6
30	Sulphates	6	23	3
2A	Free Cyanide		1	
8A	Dissolved Solids	5		

For the remaining 35 sites, samples were non-lethal to both animals. The effluents from quarries and sand and gravel plants were consistently non-toxic to either rainbow trout or *Daphnia magna*.

The most probable cause for toxicity in the Industrial Minerals Sector are the high levels of suspended solids, pH and dissolved solids.

Further information on the toxicity results can be obtained in Acute Lethality Data for Ontario's Industrial Minerals Sector Effluents<sup>5</sup>.

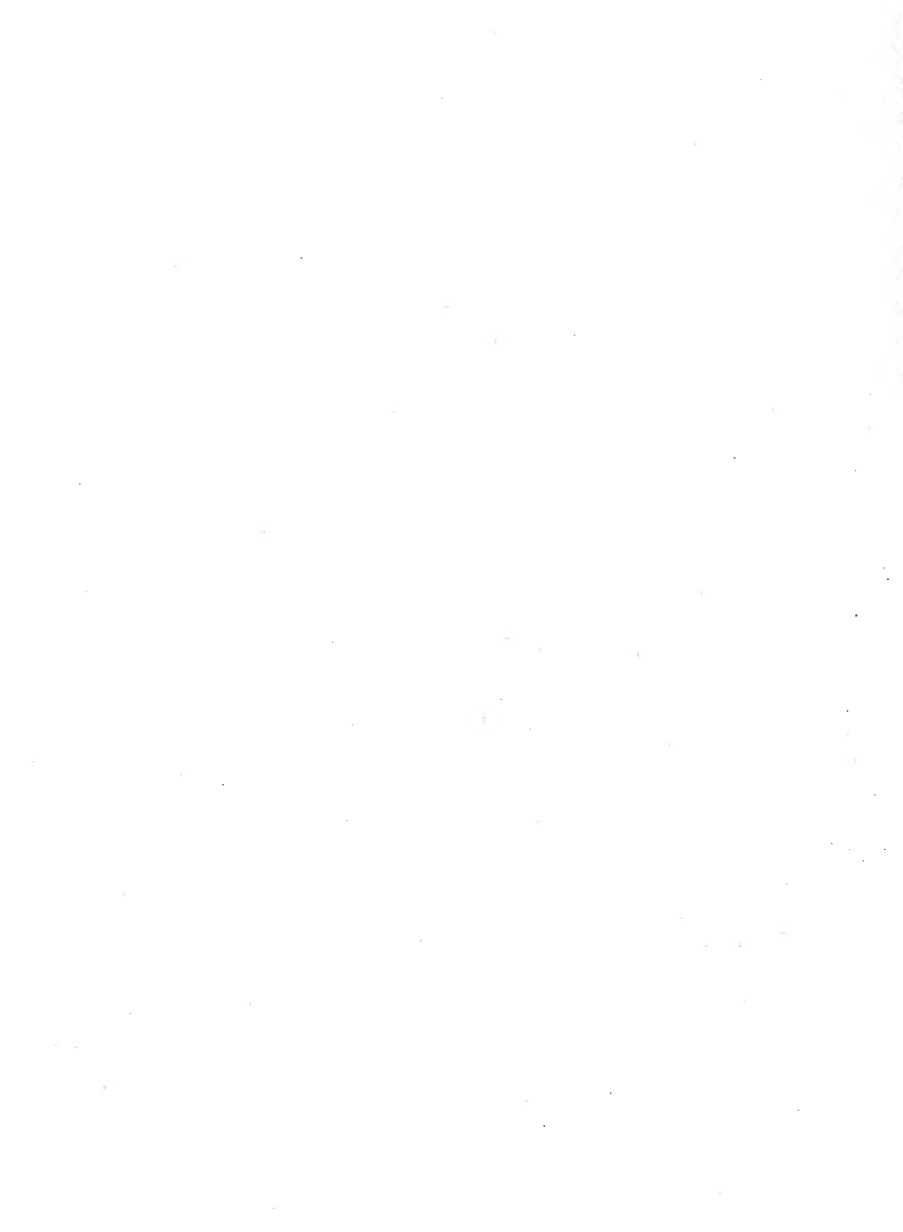
### 3.3 OTHER SOURCES

Other sources of information used in developing the monitoring regulation included existing Ministry and industry records and U.S. EPA data on cement plants and industrial mineral mines<sup>(6,7)</sup>. Best professional judgement (BPJ) of the Industrial Minerals Sector Joint Technical Committee and its associated Working Groups, based on knowledge of process chemistry, products, by-products and raw material for each category, was also important in selecting parameters to be monitored and assigning monitoring frequencies.

3.4

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THE BEST AVAILABLE TECHNOLOGY

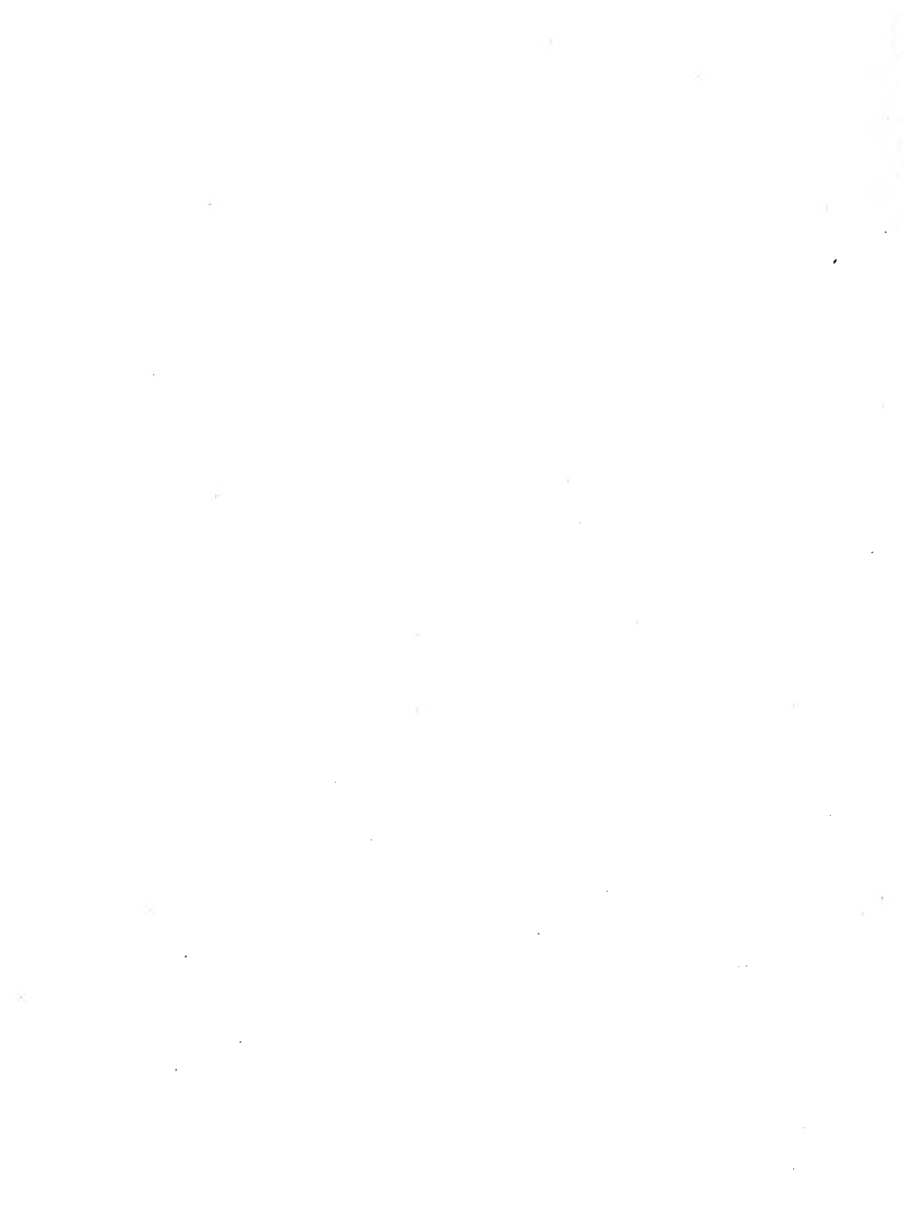
AND

ECONOMIC ASSESSMENTS

Chapter 4

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#### 4.1 BEST AVAILABLE TECHNOLOGY (BAT)

The Ministry of Environment and Energy commissioned a consultant in May 1991 to identify the best available technology (BAT) for the Ontario industrial mineral plants. A combined study of Ontario plants and plants in other parts of the world was conducted. The study results were used for the economic impact assessment for the purposes of identifying the implications of imposing the identified BAT on the Industrial Minerals Sector.

##### The BAT Working Group

A Best Available Technology (BAT) working group of the Joint Technical Committee (JTC) was formed to oversee the study and to recommend to the JTC BAT options that could be used to define best available technology options and evaluate the economic effects of applying them to Ontario plants. The working group were made up of representatives from the Ministry, ministries of Northern Development and Mines, Natural Resources and Transportation and Industry.

##### The BAT Study

The objectives of the study are summarised as follows:

- To develop an inventory of water pollution control technologies presently used at industrial mineral plants in Canada, U.S.A. and Europe, focusing on design, operating conditions, performance and capital and operating costs.
- To develop an inventory of wastewater pollution control technologies used in other industrial sectors (eg. mining) which could be applied to industrial mineral plants.
- To determine, where possible, up to five technology trains which can be applied to different plant types to achieve different levels of abatement.
- To estimate costs and contaminant removal efficiencies under each BAT option.

The list of recommended BAT options should meet the following criteria:

- A BAT option that advances the industrial minerals sector towards the MISA goal of the virtual elimination of toxics.
- A BAT option that utilizes the best technologies currently in use in North America, Europe and elsewhere.

- A BAT option selected by US EPA for similar plants.
- A BAT option that utilizes the best technologies currently in use in Ontario.
- A BAT option which produces effluent that passes the Ontario Ministry of Environment and Energy acute toxicity tests for rainbow trout and Daphnia magna.

The process for the selection of BAT options was to consider the ability of a given demonstrated technology to remove contaminants found in the industrial minerals sector.

Other considerations included:

- In-plant controls eg. reduction, reuse and recycling of wastewater and process modification.
- Collection, storage and treatment of contaminated stormwater.
- Best Management Practices (BMPs) that relate to effluent control and pollution prevention.

#### The BAT Consultant

In March of 1991, the Ministry put forth a request for tenders. The submitted proposals were reviewed by the BAT working group and the contract was awarded to Kilborn Inc. in May, 1991. Kilborn Inc. subcontracted part of the study to the Environmental Applications Group Ltd.

The consultant met with the BAT working group on June 6, 1991 to discuss the project. The BAT working group met with the consultant as required to review the progress of the study.

The first draft report was received in November 1991. After extensive reviews and changes, a final report was completed in May 1992. The report is entitled, "Ontario Ministry of the Environment: Industrial Minerals Sector: Best Available Pollution Control Technology": May 1992: Prepared by Kilborn Inc. and the Environmental Applications Group Ltd.

The report is divided into two volumes. Volume 1 discusses the non-metallic minerals (ie. cement, chemical lime, magnesium, graphite, gypsum, nepheline syenite, basalt, talc and salt. Volume 2 is dedicated to quarries, clay and shale and sand and gravel. The two volumes are bound together and the report format is the same for the two volumes.

#### 4.2 OVERVIEW OF AVAILABLE EFFLUENT CONTROL TECHNOLOGIES

The consultant's summary of treatability for the candidate parameters for limits is included in Appendix II. It was concluded by the Joint Technical Committee (JTC) that all parameters with the exception of total suspended solids and pH could not be controlled to predictable, quantifiable levels with the identified BAT treatment technologies. BAT options and technology trains were then associated with effluent quality objectives with respect to suspended solids removal.

The technologies are categorized according to the type of contaminant removed and are rated according to their utilization in the industrial minerals sector as follows:

- |               |  |
|---------------|--|
| • widely used | a commonly used method of treatment  |
| • limited use | an occasionally used method of treatment   |
| • unique      | employed at one or two related sites   |
| • pilot       | demonstrated site performance at less than full commercial scale   |
| • potential   | a method that could be used but is not due to economics, performance, limited development or present use is confined to other industries |

##### Suspended Solids Removal

Widely Used	Settling ponds Sumps
Limited Use	Tailings ponds Coagulants/flocculants Exfiltration Passive filtration Wetland filtration
Unique	Mechanical clarifiers
Potential	Mechanical filtration Filtration beds

##### pH Control

Limited Use	Sulphuric acid Carbon dioxide
Unique	Lime Limestone
Potential	Sodium Hydroxide

Oil and Grease

Limited Use	Gravity separation
Potential	Air Flotation Activated carbon adsorption

Ammonia and Ammonium

Limited Use	Natural degradation
Potential	Nitrification Break-point chlorination Ion exchange Air stripping Steam stripping

Phenolics

Potential	Natural degradation Chemical oxidation Biological oxidation Activated carbon adsorption
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Dissolved Solids

Potential	Chemical precipitation Ion exchange Reverse osmosis Electrodialysis
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#### 4.3 PERFORMANCE OF BAT OPTIONS

The BAT options are discussed on category or subsector basis. The full range of control and treatment technologies existing within each category are identified.

As indicated earlier, emphasis was focused on TSS where reliable contaminant removal performance values were found. The BAT options evaluated for each category, where possible are:

- A BAT option that utilizes the best technologies currently in use in Ontario.
- A BAT option selected by US EPA for similar plants.
- A BAT option that utilizes the best technologies currently in use in the world.
- Maximum pollution prevention option.
- Zero discharge.

Zero discharge is defined as "zero volume discharge". Virtual elimination of persistent toxic substances can be attained through either "zero volume discharge" or through "zero concentration" of pollutants.

Zero volume discharge is practised by a number of U.S. industrial mineral mining and processing companies located in arid areas.

#### 4.3.1 CEMENT CATEGORY

##### World BAT Plant

An Ontario BAT plant could not be selected. The Lafarge cement plant at Exshaw in Alberta was selected as Canadian and global BAT plant based on the overall effluent quality. The Lafarge Exshaw plant has a settling pond with 16 hours retention time and achieves a long-term average of 12 mg/L total suspended solids in the final treated effluent.

##### Non-Toxic Effluents

Effluents from four plants in the cement category were lethal to rainbow trout and/or Daphnia magna. Control of pH and suspended solids might make effluents non-lethal to the test animals.

##### Maximum Pollution Prevention

This option would include reducing the flows by recycling cooling water via evaporative cooling towers or in large ponds<sup>2</sup>. This option would substantially reduce effluent discharges at different facilities.

#### 4.3.2 CHEMICAL LIME CATEGORY

##### Ontario/World BAT Plant

The chemical lime plant of Stelco Inc. at Ingersoll was chosen as the Ontario as well as the global BAT plant. The long term average concentration of suspended solids in the effluent was reported as 7.0 mg/L, which was the lowest value recorded at the six lime plants. The wastewater is treated in an engineered settling pond with a residence time of 14.9 hours.

##### Non-Toxic Effluent

Effluents from Beachvilime Ltd., East plant in Beachville and Reiss Lime in Spragge were toxic to Rainbow trout and Daphnia

magna. Elevated pH and suspended solids were the possible cause for toxicity.

#### Maximum Pollution Prevention

Flow in excess of the design rate for the settling pond is diverted into the decant/polishing pond in periods of surges.

#### 4.3.3 MAGNESIUM CATEGORY

Timminco metals in Haley, Ontario is unique in the world. Magnesium is produced by a dry pyrometallurgical process described in Chapter 2 of this Background Document.

The long-term average concentrations of suspended solids of the magnesium plant effluent and stormwater effluent were 3.4 mg/L and 10.4 mg/L respectively. Based on effluent quality, the plant was designated as the Ontario BAT plant (the only plant in Ontario), US BAT (no US sister plant) and World BAT plant.

Maximum pollution prevention is achieved through best management practices.

The effluent was non-toxic to rainbow trout or Daphnia magna.

#### 4.3.4 GRAPHITE CATEGORY

Currently, Cal Graphite Corp. in Kearney, Ontario is the only producing graphite plant in Ontario. The process effluent is discharged in slurry form to a tailings pond which flows through a filter dam to a polishing pond. The long-term average concentration of suspended solids was 11.3 mg/L.

The consultant designated this plant as the World BAT with respect to effluent quality.

The effluent was non-toxic to rainbow trout or Daphnia magna.

#### 4.3.5 GYP SUM CATEGORY

The preferred technologies for suspended solids control in minewater are underground sumps for primary settling followed by surface settling ponds. Settling ponds are to be used for control of suspended solids in process effluent.

Effluents at Domtar Inc. in Caledonia and CGC Inc., in Hagersville were sometimes toxic to either rainbow trout or Daphnia magna due to elevated levels of suspended solids.

The long-term average concentration for suspended solids for

Westroc Industries Ltd. in Drumbo, Ontario was 10.5 mg/L.

An Ontario BAT plant could not be selected for this category.

#### 4.3.6 NEPHELINE SYENITE CATEGORY

The Unimin plant in Nephton is the only nepheline syenite producing plant in Ontario. The minewater effluent is discharged to a tailings pond for treatment. Flocculant is added to improve settling efficiency. The effluent from the tailings pond is decanted to a clarification pond prior to discharge.

The only other nepheline producing plant in the rest of the world is located in Norway. There is no effluent treatment at this plant.

The use of lime for sediment control, causing elevated pH and toxicity at the Unimin plant in Havelock has been discontinued. Unimin Limited substituted lime with a polyamine flocculant in February 1991. The MOE inspection toxicity results in May 1991 indicated that the effluent is non-toxic to rainbow trout or Daphnia magna.

#### 4.3.7 BASALT CATEGORY

The only basalt plant which is currently operating in Ontario is located in Havelock. The rock is mined from an open pit, crushed, screened and colour coated (using inorganic materials) for use in asphalt shingles.

All waste water from the colouring plant is discharged into a series of settling ponds, followed by a pumphouse pond from which water is recycled to the plant. There is 100% recycling of process water.

The only effluent consists of quarry water which is pumped to a small settling pond before being discharged to a wetland.

The long-term average concentration of the effluent discharged was 9 mg/L. The effluent was non-toxic to rainbow trout or Daphnia magna.

#### 4.3.8 TALC CATEGORY

Canada Talc Ltd. in Madoc and Luzenac Inc. in Timmins are the two producing talc mines in the province. The long-term-average (LTA) concentration of suspended solids for minewater effluents at Canada Talc and Luzenac was 9.4 mg/L and 4.0 mg/L, respectively. The LTA concentration for suspended solids for the process effluent at Luzenac was 16.9 mg/L. The

effluents were non-toxic to rainbow trout and Daphnia magna.

The preferred technologies for control of suspended solids are quarry sumps and tailings ponds in series with a polishing pond in cases where wet processing is employed.

#### 4.3.9 SALT CATEGORY

At the two salt mines in Ontario located in Windsor and Goderich, salt is obtained by underground mining and solution mining.

Effluents from the operations include:

- wastewater from wet scrubbers
- run-off from storage areas
- mine water
- evaporator condensate and bleeds

The effluents contain high levels of chlorides and dissolved solids. The effluents were consistently lethal to rainbow trout and Daphnia magna.

The consultant's study of Best Available Technology (BAT) was not able to assess the ability of the technologies reviewed to meet the MOE toxicity criteria for rainbow trout and Daphnia magna. The primary reason was the lack of information in the literature.

Toxicity data collected for the 12 months under the MISA Monitoring Regulation showed that salt minewater effluents generally failed the toxicity tests for both rainbow trout and Daphnia magna. A best available technology for reducing chlorides, which is known to be the toxic agent, was not identified.

Efforts to implement best management and best processing practices to reduce contaminants to the lowest feasible levels are recommended. Storage of salt under cover is recommended.

Settling and polishing ponds are recommended for suspended solids control.

#### 4.3.10 QUARRIES CATEGORY

The preferred technologies for the control of suspended solids in this category are quarry sumps and settling ponds or a combination of a sump and pond.

An analysis of the long-term average concentration of suspended solids from the 18 stand-alone quarries monitored showed that 16 plants had values less than 15 mg/L. Nelson Quarry in Burlington and Bertrand and Frere in L'Orignal

recorded higher values.

Seven quarries with maximum daily suspended solids concentration less than 30 mg/L were considered to be at the Ontario BAT level.

No effluent from any quarry was toxic to rainbow trout or Daphnia magna.

No persistent toxic contaminants were found in quarry effluents.

Contacts with sites in the United States and worldwide suggest that effluent quality at these locations was comparable to but not better than that already achieved in Ontario<sup>1</sup>.

#### 4.3.11 CLAY AND SHALE CATEGORY

Effluent from clay and shale category operations consists of stormwater effluent from the pit. The selected BAT options for control of suspended solids are quarry sumps, settling and decant ponds.

The clay and shale operation of Brampton Brick at Cheltenham was chosen as the Ontario and World BAT plant.

Effluents from the clay and shale plants were non-toxic to rainbow trout or Daphnia magna.

#### 4.3.12 SAND AND GRAVEL CATEGORY

There are several sand and gravel operations in the province. Some of the operation produce washed aggregates. Discharges from such operations normally contained elevated levels of suspended solids.

With the advent of MISA, all known sand and gravel pits with washing facilities installed 100% wastewater recycling systems. Currently, there is only one operation in Thunder Bay, Kam Aggregates, that has not installed recycling system.

Effluents from Kam Aggregates Ltd. were non-toxic to rainbow trout or Daphnia magna.

#### 4.4 EFFLUENT QUALITY STANDARDS AND REGULATIONS

Regulatory limits applicable to the industrial minerals sector plants in Canada, United States, Germany, France and the United Kingdom were reviewed by the BAT consultant. Guidelines and regulations were generally confined to pH,

suspended solids and oil and grease. For a large number of operations in both North America and Europe, limits have not been applied.

4.4.1 Canada - Federal Regulations

There are no Federal regulations for plants in the industrial minerals sector.

4.4.2 Canada - Provincial Regulations

Ontario

Effluent discharges from the industrial minerals sector are regulated under the Ontario Water Resources Act and the Environmental Protection Act. The current guidelines for pH, suspended solids and oil and grease are:

pH	5.5 to 10.6
Total Suspended Solids	15 mg/L
Oil and Grease	15 mg/L

Quebec

A Certificate of Authorization is required by all operations. Guidelines defined in Directive 019 - Mining Industries, are used by the Quebec Ministry of the Environment as a basis of establishing individual site limits.

pH	6.5 to 9.5
Total Suspended Solids	25 mg/L

New Brunswick

Under the Water Quality Regulation of the New Brunswick Clean Environment Act, plants are required to obtain a "Certificate of Approval to Operate".

Total Suspended Solids	25 mg/L
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Manitoba

All plants require a licence under the Environment Act. Effluent limits are based on the Federal Metal Mining Liquid Effluent regulations and Guidelines.

Total Suspended Solids	25 mg/L
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Nova Scotia

All mining operations require an industrial permit under the Nova Scotia Environmental Protection Act.

Total Suspended Solids	25 mg/L
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Newfoundland and Labrador

Newfoundland and Labrador use the limits specified in the Environmental Control (Water and Sewage) Regulations to control the effluent discharges to sewer and open water.

pH	5.5 to 9.0
Total Suspended Solids	30 mg/L above background levels
Oil and Grease	15 mg/L

Saskatchewan

All industrial mineral plants require an Approval to Operate issued by the Saskatchewan Environment.

pH	5.0 to 10.0
Total Suspended Solids	25 to 50 mg/L.

British Columbia

Limits are set on a case by case basis using the Pollution Control Objectives as a guide.

pH	6.5 to 8.5 (Fresh water)
Total Suspended Solids	25 to 75 mg/L
Oil and Grease	10.0 to 15.0 mg/L

Alberta

A licence to operate, issued by Alberta Environment is required for all operations under the Clean Water Act of Alberta. The following guidelines generally apply:

pH	6.0 to 9.5
Total Suspended Solids	35 mg/L
Oil and Grease	5 mg/L

4.4.3 UNITED STATES OF AMERICA - FEDERAL REGULATIONS

The 1974 and 1979 US EPA Development Document for Effluent Limitations Guidelines and Standards for Cement<sup>3</sup> and Mineral Mining and Processing<sup>4</sup> recommended discharge levels for plants in the industrial minerals sector. Other than for cement, graphite and gypsum, the standards have not yet been adopted into regulation.

Graphite

pH	6 to 9
Total Suspended Solids	20 mg/L (Daily Average)
	10 mg/L (Monthly Avg.)

Gypsum

Process water	zero discharge
Mine water	TSS 30 mg/L

Salt

Saline effluent discharges from the salt mining operations are monitored by the US EPA and may be controlled in conjunction with the State. Permits are issued on a case by case basis and may regulate one of the following: total dissolved solids, chlorides, total suspended solids, total flow and temperature.

4.4.4 EUROPEGermany

All industries in Germany are governed by the Federal Minimum Effluent Guidelines to the Receiver. Effluent discharge limits are determined on a case by case basis and are dependent upon the water quality and size of the receiving water.

Total Suspended Solids	100 mg/L (quarries)
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France

The mining code is the regulation which governs mining operations in France. The following criteria are used unofficially within the government:

pH	5 to 9
Total Suspended Solids	30 mg/L

### United Kingdom

Current typical limits for suspended solids from clay operations vary from 100 mg/l to 2000 mg/L, however most plants must meet a limit of 250 mg/L.

#### 4.5 ECONOMIC ASSESSMENT

In order to develop effluent limits based on the identified BAT technology trains, the Ministry conducted an economic assessment of the costs of imposing representative BAT technology trains on the industrial minerals plants and the firms that own them. The objectives of the economic assessment were to:

- derive least-cost abatement functions for each plant with estimates of costs and contaminant removals for each BAT option;
- evaluate the cost effectiveness of selected BAT options in terms of the cost per unit of pollutant removed and the incremental cost per unit of incremental pollutant removal;
- assess the potential financial and economic consequences associated with abatement program options that are cost-effective plus other MISA related costs that may be incurred by the regulated plants;
- determine the distribution of costs and contaminant reductions among plants and firms;
- analyze the ability of industry to pass on the regulatory induced costs as product price increases or factor input price decreases; and
- determine the effects of the regulation-induced costs on the competitive position of industrial mineral plants.

Full details of the economic impact assessment are presented in the Ministry report titled MISA Economic Assessment: Potential Water Pollution Programs for the Ontario Industrial Minerals Sector.

As part of the economic assessment, the estimated costs of the BAT technology trains and the contaminant removals associated with each train were used to derive abatement cost functions which show the costs of applying different technology trains associated with successively higher levels of contaminant removal. Three aggregate levels of abatement (Options 1, 2 and 3) were defined, expressed as monthly average maximum TSS concentration levels, for each plant in the sector.

The costs associated with these levels of abatement were used in the subsequent economic and financial analyses. No costs are expected to be incurred by plants which have already achieved the target objectives.

- Option 1**            Technology which produces a maximum monthly average concentration of 25 mg/L of total suspended solids in effluents discharged at each plant.
- Option 2**            Technology which produces a maximum monthly average concentration of 15 mg/L of total suspended solids in effluents discharged at each plant.
- Option 3**            Technology which is capable of achieving "zero-discharge" at each plant (resulting in 0 mg/L of TSS) through total evaporation of effluents.

In order to assess the potential financial and economic consequences associated with the implementation of the costs of each of the three levels of abatement, financial impact analyses were undertaken on 13 industrial minerals companies in Ontario which own the regulated plants and for which published financial data were available for the years 1982-1991.

For these firms, historical financial data were adjusted to determine how fifteen financial indicators would change if the costs associated with each of the three aggregate levels of abatement plus the costs associated with MISA effluent monitoring had been incurred by each firm during the relevant time period.

The financial assessments indicated that, if financial performance over the next decade mirrors that of the average performance over the last decade, the three different levels of aggregate abatement will have notably different effects on measures of company liquidity, solvency and profitability.

#### 4.5.1            Cost-Effectiveness of Options

Cost-effectiveness analysis assesses the costs per unit removal of the different options and provides indicators as to the effectiveness in removing pollutants relative to the estimated costs.

Information on the capital and operating costs to reach the three levels of abatement were provided by Kilborn and Beak. As noted earlier, a separate report is issued on the economic assessment.

Least-cost abatement functions were derived to show annualized costs of attaining the specified TSS levels in relation to estimated annualized costs.

The cost per kilogram of suspended solids removed for each BAT option was calculated. The unit costs were used to determine the most cost-effective option. The results are summarised as follows:

#### Estimated Costs, Initial Loadings and Reductions

SECTOR/OPTIONS	Initial TSS Loading (KG/year)	Option 1 25 mg/l of TSS (\$000's)		Option 2 15 mg/l of TSS (\$000's)		Option 2 Zero Discharge (\$000's)	
		Cost * (\$000s)	Final Loading	Cost * (\$000's)	Final Loading	Cost * (\$000's)	Final Loading
Cement	745,000	1,150	273,000	3,918	61,000	74,489	0
Chemical Lime	633,000	295	204,000	336	231,000	234,359	0
Salt	24,000	269	1,500	269	1,500	1,102	0
Basalt, Graphite, Nepheline, Talc	81,000	84	74,033	46,846	60,000	71,582	0
Gypsum	221,000	223	97,000	317	61,000	104,948	0
Total	1,705,000	2,022	784,000	51,685	414,000	495,979	0
Note: * = annualized after-tax operating and capital cost at 12% for 10 years.							

The results of the cost-effectiveness analysis indicate that Option 1 (Maximum Monthly Average of 25 mg/L of TSS) is associated with the lowest annualized cost for the sector and is the most cost-effective option. The estimated costs per kilogram of TSS removed, for the 25 firms for which data was available, are \$1.86, \$37.25 and \$290.93, for Options 1, 2 and 3, respectively.

#### 4.5.2 Financial Impact Assessment

The financial and economic implications of potential MISA-related abatement costs are analyzed assuming that all potential water pollution abatement and monitoring costs will be absorbed by the regulated firms. Consistent with the draft Issues Resolution Committee Report (June 1990), financial performance data over the past 10 years are used as a basis for assessing the potential financial effects of the relevant monitoring and abatement costs for the sector as a whole, the constituent firms and, where data are available, for individual plants. Estimated MISA-related costs are added to the costs associated with past financial performance data and the changes in relevant financial measures and indicators are used to examine the implications for individual firms and for the sector.

Comparisons of potential MISA-related compliance costs with expected **future financial performance indicators** constitutes one approach with which to judge the effects of potential regulatory costs. This analytical approach could not be implemented for the industrial minerals sector because financial performance forecasts for individual plants or firms were unavailable from either the companies or from independent sources.

Analyses presented in this chapter are based on published data from Statistics Canada, from the consolidated financial reports of each company, and from other sources noted as used. From a public perspective, assessments of the implications of increased regulatory costs at the firm and the industry (or sector) level would be important and useful for the following reasons:

- a. Intra-firm transfer prices for a particular plant may not reflect true market conditions.
- b. Corporate resources may be available that are not recorded in plant-level income statements.
- c. The firm rather, than the plant, would have to raise the funds for implementing regulatory requirements.

In some cases, consolidated financial data may not accurately represent individual plants operated by industrial minerals companies because these data include revenues and costs of different business segments and of plants and facilities operating outside of Ontario. Only the 13 firms for which the Ministry has complete, published financial data for the years 1982 to 1991 were subject to analysis.

Financial analyses are performed by adjusting or "shocking" **historical financial data** with the relevant MISA-related costs to determine how each indicator would have changed if the costs would have been incurred during the relevant time period.

Insights from financial statements are based on relationships between financial indicators in the statements (i.e. financial ratios, percentage changes) and on trends in these relationships or specific financial indicators (comparative time-series analysis). Incremental regulatory costs may be added to financial statements to determine how ratios, percentage changes and absolute values of historical financial indicators would change and by what magnitude. While such an approach is useful, several caveats must be mentioned regarding financial statement analysis.

Financial statements are records of the past. Whenever such information is used in a future-looking decision making process, the past is assumed to be a reasonable basis for predicting the future.

Also, ratios and trends serve as "red flags" regarding problem areas. While ratio and trend analyses help identify past and present financial weaknesses of a company, they do not necessarily reveal the underlying cause of the results.

Finally, a single ratio by itself does not fully characterize a firm's financial performance just as a single pollution parameter will not represent water quality. Moreover, it is not often possible to judge the importance of a given value of a ratio or financial indicator or specific changes in these values. Therefore, an inventory of financial indicators and ratios is needed to gauge a firm's performance and some standard or threshold against which to compare financial indicators are needed to judge and evaluate the importance of specific changes. Such a standard may be based on industry averages, on historical results of a particular firm or competitors or on planned performance levels.

#### 4.5.3 Financial Indicators and Thresholds

Cost estimates associated with the MISA Monitoring Regulations were evaluated on the basis of three financial indicators: after-tax return on investment or capital employed, capital investment and after-tax profits. After-tax return on investment or capital employed was used because it represents the return that provides the incentive for owners and investors to keep their capital in a particular enterprise or to move their money to another business that may be more profitable. Incremental operating costs as a percent of after-tax profits shows the amount that these profits could be reduced by the regulatory requirements. Similarly, the incremental capital costs to comply with regulatory requirements as a proportion of past capital expenditures indicates the proportion of the firm's available capital funds that might have to be diverted from other uses.

The U.S. EPA commissioned studies to determine which financial indicators and ratios best predict business failure. Three ratios were found by U.S. EPA contractors to have strong empirical correlation with business failure: return on assets, total debt to total assets and cash flow to total debt.

The six ratios noted above and others are used in the analyses discussed below.

### Adjustment Procedure

Total MISA-related capital and operating costs for each of the three levels of abatement plus actual or estimated MISA monitoring costs were added to appropriate items in the income statement and balance sheet for each firm for which data were available.

The "adjustment" procedure consists of the following steps:

1. "Before abatement, average" income statements and balance sheets were calculated using firm level financial data over the previous 10 years.
2. "Before abatement" financial indicators and ratios for the most recent year (1991) and the 10 year average were calculated.
3. Potential MISA costs were added to financial statements for the most recent year (1991), and the 10 year average.
4. "After abatement" financial indicators and ratios for the most recent year and the 10 year average were calculated.

The significance of the resulting ratios and indices may be evaluated two ways:

- the magnitudes of changes between the "before-abatement" and "after-abatement" results; and
- the "after abatement" indicators may be compared with threshold values defined below.

For the purpose of these analyses, an assumption had to be made as to how the capital costs of the potential abatement technologies would be financed. For example, both capital and operating costs may be deducted during a single year to show the absolute worst-case impact if expenses were financed entirely out of current revenues. For purposes of this assessment, it is assumed that the capital costs are financed by debt at 12% per annum over ten years, with operating costs deducted from current revenues. This in keeping with evidence on the long-run pre-tax real rate of return in the Canadian manufacturing sector.

As discussed in the draft Issues Resolution Process Committee Document (June 1990), there are no widely accepted and unequivocal thresholds by which one may determine whether a particular level of cost or whether specific magnitudes of changes in financial indicators is "economically achievable" for a firm or an industrial sector. In this analysis, the "after abatement" financial indicators may be compared with the following values in order to judge financial impact;

- a) "before abatement" ratios for the most recent year and a ten year average;

- b) "before abatement" historical averages for the industry as a whole;
- c) threshold values that are recommended and agreed upon by industry and/or financial analysts; or
- d) "before abatement" ratios and indicators that were recorded (by a firm or for the industry as a whole) during the "worst year" in terms of before-tax profit (ie. operating income) over the last ten years.

Historical ratios for the past ten years were calculated for each firm in order to assess the past and current financial condition. These ratios are included in the Ministry report titled MISA Economic Assessment: Potential Water Pollution Programs for the Ontario Industrial Minerals Sector.

### Financial Implications of Option 1 Scenario

Achievement of Option 1, 25 mg/l monthly average TSS concentration or better, could cost the 25 industrial mineral plants an estimated total of \$12.5 million in capital costs and \$1.2 million in annual operating costs, or about \$3.4 million before-tax (\$2.0 million after-tax) on an annualized basis over ten years.

Analysis of cost per kg. removed and incremental cost per incremental kg. removed indicated that this option is the most cost-effective (\$1.86 per kilogram removed).

Comparing "after-abatement" financial indicators with actual ten-year average performance indicators, effects on firms were small to negligible in terms of changes in profitability and liquidity measures.

For example, the average decrease in after-tax profit for the 13 firms for which financial data are available could be as high as \$120,000, a decrease of 0.1% from an average ten year profit of \$19.2 million. Changes in profitability indicators, such as return on assets and return on capital employed, and changes in liquidity indicators due to costs associated with Option 1, were less than 0.2% for all firms, except one firm which could incur a 0.5% and 0.3% decrease in return on capital and return on assets.

If these firms finance the capital costs to meet the recommended effluent limits over a ten year period, these costs would represent an average of 0.8% (if after-tax annualized costs are applied) of the average capital expenditures incurred by these firms over the past ten years, with the largest being 3.7% of average capital expenditures for one firm.

When MISA-related costs are applied to the financial indicators for the most recent year (1991), which has been the worst year for many firms, changes in financial performance indicators are similar to those observed when costs were applied to the ten-year averages.

#### Financial Implications of Option 2 Scenario

Compliance with the Option 2 requirement of 15 mg/l monthly average TSS concentration or better, could cost the 25 industrial mineral plants an estimated total of \$47 million in capital costs and \$78 million in annual operating costs, or about \$86 million before-tax (\$52 million after-tax) on an annualized basis over ten years.

Analysis of cost per kg. removed and incremental cost per incremental kg. removed indicated that, with an average cost of \$37 per kilogram removed, this option is the not as cost-effective as Option 1, but more cost-effective than Option 3.

Using ten-year average performance indicators, effects on firms were medium to large in terms of changes in profitability and liquidity measures. For example, the average decrease in after-tax profit for the 25 firms for which financial data was available could be as high as \$6.3 million, a decrease of 33% from an average ten year profit of \$19.2 million. Average decreases in profitability indicators could be as high as a 17% decrease in return on capital and a 22% decrease in return on assets.

If regulated firms finance the estimated capital costs over a ten-year period, these costs would represent an average of 12% (if after-tax annualized costs are applied) of the average capital expenditures incurred by these firms over the past ten years, with the largest impact being 96% of average capital expenditures for one firm.

#### Financial Implications of Option 3 Scenario

Compliance with Option 3, or zero-discharge of water, could cost the 25 regulated industrial mineral plants an estimated total of \$179 million in capital costs and \$795 million in annual operating costs, or about \$827 million before-tax (\$496 million after-tax) on an annualized basis over ten years.

Requiring the evaporation technology at each plant would result in the highest cost per kg. removed (\$291).

Compared with the ten-year average performance indicators, effects on firms were very large in terms of changes in profitability and liquidity measures.

For example, the decrease in average after-tax profit for the 13 firms for which financial data was available could be as high as \$34 million, or 180% of the average ten year profit of \$19.2 million. Average changes in profitability indicators, such as return on assets and return on capital employed, are estimated to be greater than 42% for the firms.

If industrial mineral firms finance the estimated capital costs by debt over a ten-year period, these costs would represent an average of 95% (if after-tax annualized costs are applied) of the average capital expenditures incurred by these firms over the past ten years; in one case, capital costs would amount to 9 times of the average capital expenditures.

### Summary

The assessment indicates that Option 1, a maximum allowable monthly TSS concentration limit of 25 mg/l, is the most cost-effective option and that the estimated costs associated with compliance with this option are unlikely to cause significant financial duress.

Compliance with Option 2, a maximum allowable monthly TSS concentration limit of 15 mg/l, is expected to have a notably greater negative impact on the financial performance of the firms for which sufficient data was available. An additional annualized after-tax expense of \$49.6 million are estimated to be necessary for the sector to comply with this option.

Compliance with Option 3, zero-discharge of water, is estimated to have very significant negative impacts on the financial and economic conditions of most firms analyzed.

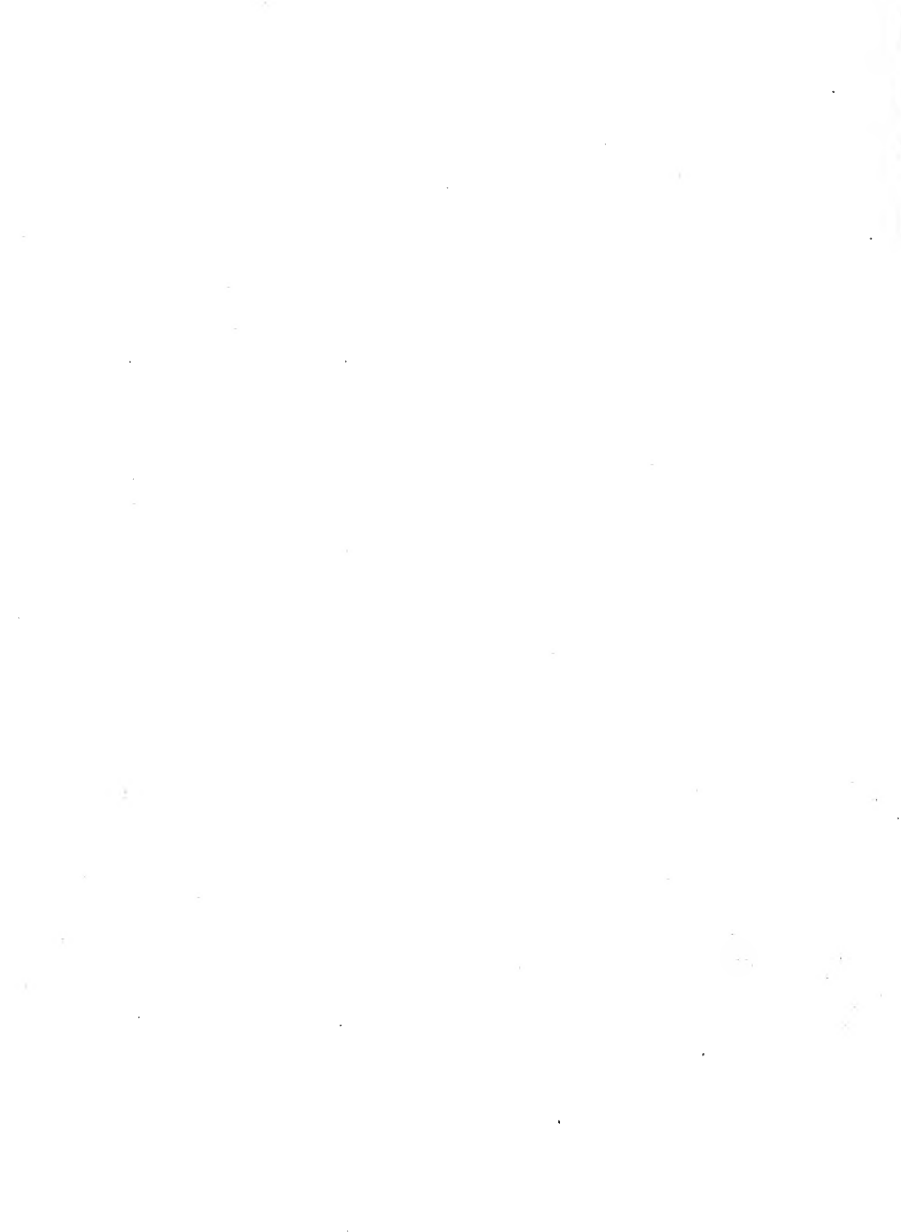
The financial and economic assessment of the proposed Limit Options is detailed in the Ministry report titled MISA Economic Assessment: Potential Water Pollution Programs for the Ontario Industrial Minerals Sector.

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1. Kilborn Inc. and Environmental Applications Group Ltd., "Ontario Ministry of the Environment; Industrial Minerals Sector: Best Available Pollution Control Technology", May 1992.
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3. US EPA, "Development Document for Effluent Limitations and Guidelines and New Source Performance Standards for the Cement Manufacturing Point Source category", January 1974, Washington, DC.
4. US EPA, "Development Document for Effluent Limitations and Guidelines and New Source Performance Standards for the Mineral Mining and Processing Point Source Category", July 1979, Washington, DC.
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## **THE EFFLUENT LIMITS**

### **CHAPTER 5 OF THE DEVELOPMENT DOCUMENT**



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## **5.1 THE SELECTION OF LIMITED PARAMETERS**

### **Candidate Parameter Selection**

The candidate parameter list was established according to the general steps described in the draft Issue Resolution Committee Reports on Limits Setting and Data Analysis. The following steps were followed:

- The effluent monitoring data were analyzed in order to determine the parameters which were statistically present in the effluent.
- Parameters identified as being statistically present in the effluent were analyzed using rigorous Quality Assurance/Quality Control (QA/QC) data assessment procedures.
- The identified BAT technology train options were assessed as to their ability to treat the parameters remaining after the QA/QC data assessment.
- "Special parameters", that pose a significant threat to human health and the environment, were assessed in order to determine if they should be added to the candidate parameter list.

Based on the candidate parameter selection criteria outlined in Chapter 3 of this Background Document and following QA/QC data assessment, 34 parameters were identified as candidate parameters for effluent limits setting for the industrial minerals sector.

### **Candidate Parameter Review**

The final list of parameters, after QA/QC assessment, were evaluated for treatability using information gathered on the best available technology. The treatability table for the found parameters is attached as Appendix II. Stormwater effluents were not evaluated for treatability because they will not be limited. Instead, all companies will be required to conduct a storm water control study (SWCS) to fully assess impacts and control options.

A summary of the monitoring results are presented in Appendix III. Sixty-eight effluent streams were monitored at forty-seven plant sites. The long term average concentration of all found parameters at each plant are listed by effluent types. The RMDL of the parameters, the total number of samples taken

and the samples that had values greater than the RMDL are also indicated.

The found parameters were reviewed for limit setting. The review criteria included:

- the frequency of occurrence of the parameter in the industrial minerals sector effluents
- the source of the parameter
- the limitation of the parameter in other jurisdictions
- availability of BATEA for the removal of the parameter

The following section discusses the results of the candidate parameter review.

#### TOTAL CYANIDE

##### WEAK ACID DISSOCIABLE CYANIDE

RMDL = 0.005 mg/L

Total cyanide refers to all simple and complex forms of cyanide including cyanuric acid (hydrogen cyanide), cyanide ion, metal cyanides of zinc, cadmium, copper, nickel, gold, cobalt and iron. Weak Acid Dissociable cyanide refers to only cyanuric acid and free cyanide ions, Appendix IV.

Total cyanide was found in 6 out of 68 effluent streams sampled in the industrial minerals sector.

The main source of cyanide in the industrial minerals sector is sodium ferrocyanide which is added to salt as an anti-caking agent.

Cyanide is not regulated in the industrial minerals sector in any jurisdiction.

There is no demonstrated technology within the sector to treat the low levels of cyanide present in effluents. Cyanide was not considered further for effluent limits.

##### AMMONIA PLUS AMMONIUM

RMDL = 0.25 mg/L

Ammonia plus ammonium is a measure of ionized and un-ionized ammonia (un-ionized ammonia is toxic to fish).

Ammonia plus ammonium was found in 26 out of 68 effluent streams sampled in the industrial minerals sector.

The main source of ammonia and ammonium is the explosives used in mining.

The current Ontario guideline for the control of ammonia plus ammonium is 10 mg/L (as nitrogen). British Columbia has guidelines that range from 1 mg/L to 10 mg/L.

Demonstrated technology is not available in the sector for treatment of ammonia plus ammonium at low levels; therefore, ammonia plus ammonium was not considered further for effluent limits.

#### TOTAL KJELDAHL NITROGEN

RMDL = 0.5 mg/L

Total Kjeldahl Nitrogen (TKN) is a measure of both organic nitrogen and total ammonia.

Total Kjeldahl nitrogen was monitored only in the salt category and found in 5 effluent streams.

Total Kjeldahl nitrogen is not regulated in the industrial minerals sector in any jurisdiction.

Demonstrated technology is not available in the sector for treatment; therefore, Total Kjeldahl nitrogen was not considered further for effluent limits.

#### NITRATE + NITRITE

RMDL = 0.25 mg/L

Nitrate + nitrite is a measure of total oxidized nitrogen.

Nitrate plus nitrite was found in 35 out of 68 effluent streams sampled in the industrial minerals sector.

The source of nitrate plus nitrite is ammonium nitrate which is a component of explosives used in most quarry and underground mining operations. Run-off from nearby farms could also contribute to nitrates.

Nitrate + nitrite is not regulated in the industrial minerals sector worldwide. The guidelines for metal mining sector plants in British Columbia varies between 10 and 25 mg/L (as N)

Because of the low levels found in the sector, nitrate plus nitrite was not considered further for effluent limits.

DISSOLVED ORGANIC CARBON (DOC)                      RMDL = 0.5 mg/L

DOC measures water soluble portion of organic carbon.

DOC was found in 36 out of 68 effluent streams sampled in the industrial minerals sector.

DOC is not regulated in the industrial minerals sector in any jurisdiction.

As the levels found were low, DOC was not considered further for effluent limits.

TOTAL ORGANIC CARBON (TOC)                      RMDL = 5 mg/L

TOC measures both particulate and dissolved carbon.

TOC was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

TOC is not regulated in the industrial minerals sector in any jurisdiction.

Due to the low levels found in effluents in the sector, TOC was not considered further for effluent limits.

TOTAL PHOSPHORUS                      RMDL = 0.1 mg/L

Phosphorus (total) was found in 6 out of 68 effluent streams sampled in the industrial minerals sector.

Phosphorus is found as suspended particles of apatite (calcium phosphate) in the industrial minerals sector effluents. Particulate phosphorus can be controlled by the control of suspended solids.

The current Ontario guideline for phosphorus is 1.0 mg/L. British Columbia has guidelines ranging from 2.0 to 10.0 mg/L.

As the levels were low, phosphorus was not considered further for effluent limits.

TOTAL SUSPENDED SOLIDS

RMDL = 5 mg/L

Total suspended solids (TSS) was found in 62 out of 68 effluent streams sampled in the industrial minerals sector.

TSS in the industrial minerals effluents mainly consist of carbonates, silicates, oxides, and sulphates.

The current Ontario Guideline for TSS is 15 mg/L. Other jurisdictions regulate TSS between 25 mg/L and 100 mg/L.

Demonstrated technologies are available for the control of TSS; hence TSS is to be limited in the industrial minerals sector.

ALUMINUM

RMDL = 0.03 mg/L

Aluminum was found in was found in 28 out of 68 effluent streams sampled in the industrial minerals sector.

Aluminum is present as silicates and oxides in the sector. Nepheline syenite and the clay minerals mined in the sector contain variable amounts of aluminum. In general, aluminum is present in effluents as suspended solids.

Aluminum is not regulated in the industrial minerals sector in any jurisdiction. However, it is regulated in the metal mining sector. The typical range is 0.5 mg/L to 2 mg/L worldwide.

In the industrial minerals sector, the levels of aluminum are relatively low. Aluminium is controlled as a component of total suspended solids and therefore has not been considered further for limits.

CADMIUM

RMDL = 0.002 mg/L

Cadmium was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

Cadmium is rarely found in the industrial minerals sector. It is generally found in trace quantities as cadmium sulphide in association with zinc sulphide (sphalerite). These sulphides are found in the industrial minerals sector effluents as suspended particles and can be controlled by controlling suspended solids.

Cadmium is regulated in the metal mining sector within the range of 0.001 mg/L to 0.5 mg/L worldwide. The Ontario guidelines of 0.001 mg/L is the most stringent worldwide.

As the levels were low, cadmium was not considered further for effluent limits.

#### COBALT

RMDL = 0.02 mg/L

Cobalt was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

Cobalt is found in trace quantities in the industrial minerals sector associated with trace amounts of arsenic, iron and sulphur. These minute quantities of minerals are found in the industrial minerals sector effluents as suspended particles and can be controlled by controlling suspended solids.

Cobalt is not regulated in the industrial minerals sector in any jurisdiction. The guidelines for metal mines in the British Columbia range from 0.5 mg/L to 1 mg/L.

As the levels were low, cobalt was not considered further for effluent limits.

#### COPPER

RMDL = 0.01 mg/L

Copper was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

Copper is found in the industrial minerals sector as chalcopyrite, a copper-iron sulphide mineral. Trace amounts of chalcopyrite may be associated with the host non-sulphide minerals (carbonates, silicates and oxides). Particles of chalcopyrite were present in only two of the effluents sampled in the industrial minerals sector.

The range for the control of copper in North American jurisdictions is 0.15 mg/L to 1 mg/L.

As the levels found were near the level of detection, copper was not considered further for effluent limits.

MOLYBDENUM

RMDL = 0.02 mg/L

Molybdenum was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

Molybdenum is found as a trace sulphide mineral, molybdenite, in the non-sulphide ores of the industrial minerals sector. Molybdenum may be present in the industrial minerals sector effluents in the form of suspended solids.

Molybdenum is not regulated in the industrial minerals sector. There are guidelines for metal mines in British Columbia in the range of 0.5 mg/L to 5 mg/L.

As the levels found were low, molybdenum was not considered further for effluent limits.

NICKEL

RMDL = 0.02 mg/L

Nickel was found in 3 out of 68 effluent streams sampled in the industrial minerals sector.

Nickel is found in trace amounts as pentlandite (nickel-iron sulphide mineral) and other nickel minerals in ore deposits. Nickel present in industrial minerals effluents may be in the form of particles.

Nickel is not regulated in the industrial minerals sector in any jurisdiction. The range for nickel control in the metal mining sector in North America is 0.2 mg/L to 1 mg/L.

As the levels found were low, nickel was not considered further for effluent limits.

VANADIUM

RMDL = 0.03 mg/L

Vanadium was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

The source of vanadium is the naturally occurring vanadium in coal and petroleum coke used at some of the plants.

Vanadium is not regulated in the industrial minerals sector worldwide.

The levels are low; therefore, vanadium was not considered further for effluent limits.

ZINC

RMDL = 0.01 mg/L

Zinc was found in 18 out of 68 effluent streams sampled in the industrial minerals sector.

Zinc may be found in the industrial minerals sector as sphalerite (zinc sulphide), zincite (zinc oxide) or smithsonite (zinc carbonate) in ore deposits. Zinc in effluents may be present as particles of zinc minerals.

No information was obtained worldwide on regulation of zinc in the industrial minerals sector. In the metal mining sector, jurisdictions in North America regulate zinc between 0.2 mg/L and 1.5 mg/L.

As the levels are low in the industrial minerals sector, zinc was not considered further for effluent limits.

ARSENIC

RMDL = 0.005 mg/L

Arsenic was found in 3 out of 68 effluent streams sampled in the industrial minerals sector.

Arsenic is generally present in trace quantities as arsenopyrite (iron-arsenic sulphide mineral). In some cases, arsenic is found as an oxide. Arsenic in the industrial minerals effluents is found as particles of arsenic minerals.

Arsenic is not regulated in the industrial minerals sector in any jurisdiction. In the metal mining sector, jurisdictions in North America regulate arsenic between 0.1 mg/L and 1 mg/L.

As the levels were close to the RMDL, arsenic was not considered further for effluent limits.

PHENOLICS (4AAP)

RMDL = 0.002 mg/L

Phenolics (4-amino antipyrine test, 4AAP) was found in 24 out of 68 effluent streams sampled in the industrial minerals sector.

The 4-amino antipyrine test is a colorimetric test that is used to detect hydroxybenzene compounds (phenolic compounds) in aqueous samples. The test has a limited capability to accurately measure the actual concentration of phenolic compounds in aqueous samples. Many forms of phenol are inadequately measured or not detected at all by the 4AAP test.

Phenolic compounds can be natural or man-made. Naturally occurring phenolics can be formed through the decomposition of plant matter.

Phenolics are not regulated in the industrial minerals sector in any jurisdiction except in Ontario. The Ontario Guideline for phenolics is 0.02 mg/L.

As the levels in the effluents in the sector were low, phenolics were not considered further for effluent limits.

#### SULPHIDE

RMDL = 0.02 mg/L

Sulphide was found in 14 out of 68 effluent streams sampled in the industrial minerals sector.

Sulphide is often present in groundwater and wastewaters. It is mostly due to the bacteria reduction of sulphates.

Sulphide is regulated only in Germany at 1.0 mg/L.

Because of the low levels found in effluents in the sector, sulphide was not considered further for effluent limits.

#### TOLUENE

RMDL = 0.5 ug/L

Toluene was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The source of toluene could not be determined. The most likely source could be an organic cleaner or de-greaser that contains toluene.

Toluene is not regulated in any jurisdiction in the industrial minerals sector.

As the levels found were low, and no demonstrated technology in the sector could be found, toluene was not considered further for effluent limits.

DI-N-BUTYL PHTHALATE

RMDL = 3.8 ug/L

Di-n-butyl phthalate was found in 2 out of 68 effluent streams sampled in the industrial minerals sector.

Di-n-butyl phthalate is a common laboratory contaminant. The PVC piping at the plants may also contribute to the presence of this contaminant in effluents.

Di-n-butyl phthalate is not regulated in any jurisdiction in the industrial minerals sector.

As the levels found in the sector effluents were low, di-n-butyl phthalate was not considered further for effluent limits.

PHENANTHRENE

RMDL = 0.4 ug/L

Phenanthrene was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The source of phenanthrene is coal which is used for energy in some cement and lime plants in the sector.

Phenanthrene is not regulated in any jurisdiction in the industrial minerals sector.

As the levels found in the sector effluents were low, and no demonstrated technology was identified within the sector, phenanthrene was not considered further for effluent limits.

2,4-DIMETHYLPHENOL

RMDL = 7.3 ug/L

2,4-Dimethylphenol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

2,4-Dimethylphenol was not considered further for effluent limits as the levels found were low and no demonstrated technology for control was available within the sector.

PHENOL

RMDL = 2.4 ug/L

Phenol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

Phenol is not regulated in any jurisdiction in the industrial minerals sector.

Phenol was not considered further for effluent limits as the levels found were low and no demonstrated technology was identified within the sector for the control of phenol.

m-CRESOL

RMDL = 3.4 ug/L

m-Cresol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The use of coal in some lime plants is the main source of m-cresol.

m-cresol is not regulated in any jurisdiction in the industrial minerals sector.

As no technology was identified within the sector, m-Cresol was not considered further for effluent limits.

o-CRESOL

RMDL = 3.7 ug/L

o-Cresol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The presence of o-cresol in effluents in the sector is mainly attributed to the use of coal as an energy source.

o-cresol is not regulated in any jurisdiction in the industrial minerals sector.

As no technology was identified within the sector, o-Cresol was not considered further for effluent limits.

p-CRESOL

RMDL = 3.5 ug/L

p-Cresol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The presence of p-cresol in effluents in the sector is mainly attributed to the use of coal as an energy source.

p-Cresol is not regulated in the industrial minerals sector in any jurisdiction.

As no technology was identified within the sector, p-cresol was not considered further for effluent limits.

PENTACHLOROPHENOL

RMDL = 1.3 ug/L

Pentachlorophenol was found in 1 out of 68 effluent streams sampled in the industrial minerals sector.

The source of pentachlorophenol in the effluents could not be determined. A possible source could be the use of treated timber (wood).

Pentachlorophenol is not regulated in the industrial minerals sector in any jurisdiction.

As the levels found in the sector effluents were low and there was no demonstrated technology in the sector for treatment; pentachlorophenol was not considered further for effluent limits.

OIL AND GREASE

RMDL = 1.0 mg/L

Oil and grease was found in 44 out of 68 effluent streams sampled in the industrial minerals sector.

The main sources of the oil and grease at most plants are the lubricants used in equipment, machinery and vehicles.

Oil and grease is regulated in Ontario, Alberta and British Columbia as guidelines. The guidelines range from 5 mg/L to 15 mg/L.

Emulsions are not common in the sector. Oil and grease is normally found in the industrial minerals sector floating on

the surface of effluents.

Baffled sumps, and oil skimmers are commonly used in the industrial minerals sector. Waste oils are normally sent to a refiner of waste oils.

Generally, problems are encountered in the industrial minerals sector in the sampling and analysis of oil and grease. As most oil and grease float on the surface of effluents, it is difficult to prove that any sample taken is actually representative of an effluent.

With respect to analysis, the solvent normally used by the Ministry to recover oil and grease from industrial minerals sector effluents is a chlorinated organic. The use of chlorinated organics should not be encouraged. During the MISA effluent monitoring period private laboratories contracted by industry used methylene chloride or Freon. Freon is being phased out.

Various environmental agencies are currently evaluating a number of alternative solvents for use in the test. Each solvent, including those currently in use, tends to extract oil and grease with an efficiency and rate that is specific to that particular solvent. As a consequence, oil and grease results for an effluent tend to differ depending on the type of solvent used.

The industrial minerals sector's Joint Technical Committee concluded that the sampling and analytical procedures currently available for oil and grease were controversial and were unlikely to consistently produce results that would accurately reflect the true nature of the sector effluents.

Control of oil and grease is by Best Management Practices. Hence, oil and grease was not considered further for effluent limits setting.

#### CHLORIDES

RMDL = 2 mg/L

Chlorides were found in 31 out of 68 effluent streams sampled in the industrial minerals sector.

In the United States of America, saline effluents from salt mining operations are primarily monitored by the US EPA, but may be controlled in conjunction with the State. Michigan does not regulate salt in effluents. New York State Permits allow up to 40,000 mg/L of chlorides (net) and 80,000 mg/L of dissolved solids in effluents. In Alberta, the guidelines for chlorides is 35,000 mg/L.

Demonstrated treatment technology is not available in the sector; therefore, chlorides were not considered further for effluent limits.

#### FLUORIDE

RMDL = 0.1 mg/L

Fluoride was monitored only in the Clay and Shale subsector. It was found in the six stormwater effluents monitored in the subsector.

The main source of fluoride is the clay and shale (the raw materials) used in brick making. It is generally recognised that fluorine is incorporated in the structure of clays and sheet silicate minerals (shale, kaolinite, halloysite, illite, montmorillonite) by substitution in lattice positions for hydroxyl groups. Fluorite (calcium fluoride) can occur in rare cases as an accessory mineral in clay. Fluorine emissions are known to occur at brick plants. For stand-alone clay pits, fluoride levels in storm water are close to the RMDL. With respect to air emission control, dry sorption devices employ limestone as a sorption medium so that fluorine ions displace carbon dioxide on the limestone particle surface producing a coating of calcium fluoride on the surface.

Fluoride is regulated in mining effluents in British Columbia. The guidelines range from 2.5 to 10 mg/L.

Stormwater effluents were not evaluated for treatability because they will not be limited. Instead, all companies that discharge process effluent as well as stormwater will be required to conduct a storm water control study (SWCS) to fully assess impacts and control options.

#### SULPHATES

RMDL = 5 mg/L

Sulphates were found in 32 out of 68 effluent streams sampled in the industrial minerals sector.

Demonstrated treatment technology is not available in the sector; therefore, sulphates were not considered further for effluent limits.

DISSOLVED SOLIDS

RMDL = 0.02 mg/L

Dissolved solids were monitored only in the salt category and were found in 5 effluents.

Dissolved solids are generally not regulated in the industrial minerals sector. New York State Permits allow up to 80,000 mg/L of dissolved solids in effluents.

Demonstrated treatment technology is not available in the sector; therefore, dissolved solids were not considered further for effluent limits.

**The Final Candidate Parameters List**

Based on the technical review, total suspended solids remained as the only candidate parameter for which effluent limits can be set.

Total suspended solids provides a gross measure of suspended material including volatile suspended solids (organic) and inorganic materials. The organic fraction may include grease, oils, fibres and dispersed insoluble organic compounds. Inorganic materials include sand, silt, clay and insoluble metal compounds. Suspended solids may be a substrate for toxic contaminants which can leach out in water. Suspended solids may increase turbidity of water thereby reducing its recreational value. Photosynthetic activity of aquatic plants may be impaired. Upon settling, suspended solids can form sludge banks affecting fish spawning areas. It has been demonstrated that in the industrial minerals sector one of the causes of toxicity is elevated total suspended solids.

The limits regulation also requires the control of pH within the range of 6.0 to 9.5. Acute lethality testing using rainbow trout and Daphnia magna as test organisms is also required.

## **5.2 THE EFFLUENT LIMITS SETTING PROCESS**

### **The Method of Effluent Limits Setting**

The concentration-based limits setting process consists of the following steps:

**Step 1      Calculate the Long-Term Average (LTA) Concentration**

The value is calculated as the arithmetic average of the LTA concentration data from the BAT(EA) plants.

**Step 2      Calculate the Average Concentration Variability Factor**

This value is calculated as the arithmetic average of the variability factors from the BAT(EA) plants.

**Step 3      Calculate the BAT(EA) Performance Value**

The product of the LTA concentration and average variability factor is the daily or monthly limit for that parameter.

**Step 4      Evaluation of Economic Achievability**

Various limit options are examined to provide input into the limit setting exercise.

### **The Form of Effluent Limits**

Effluent limits can be expressed as production-based loading limits, loading limits or concentration limits and limits can be set on a daily, weekly or quarterly basis.

For the MISA Industrial Minerals Sector, concentration-based limits will apply to all sector plants as there is no consistent correlation between production and flow. Generic maximum daily and monthly average concentration limits have been calculated for all plants. The daily limits reflect unavoidable short term fluctuations in plant effluent quality while monthly average concentration limits smooth out short term fluctuations and allow more stringent effluent limits to be set.

### 5.3 EFFLUENT LIMITS SETTING

Based on the monitoring data, nine plants with average suspended solids concentration less than 15 mg/L were selected as the "Best Plants" in the Industrial Minerals Sector. These plants are listed in Table 5.1.

Data from quarries were excluded in the exercise as quarry operations were less complex compared to the processes carried out in the other subsectors.

#### **Long-term Average (LTA) Concentrations**

Long-term average concentrations were calculated as the arithmetic mean of all the data collected.

Table 5.1  
Best Performance Plants

Plant	Location
Lafarge Canada Inc.	Bath
Guelph Dolime	Guelph
Steetley Quarry Products	Dundas
Stelco Inc.	Ingersoll
Timminco Ltd.	Haley Station
Westroc Industries Ltd.	Drumbo
Canada Talc Ltd.	Madoc
Cal Graphite Corp.	Kearney
Luzenac Inc.	Timmins

#### **Variability Analysis**

The treatment system of better than average plants should be able to meet the Long Term Average (LTA) on an average basis, but will still show variability on a daily or monthly basis. Therefore an accurate estimate of this variability is essential to develop realistic effluent concentration limit guidelines. A plant should be able to comply with the daily and monthly limitations under normal operating conditions.

The variability factors, which are the ratio of either the 95th or 99th percentile to the mean, available for each BAT plant, to take into account this variability or uncertainty in the effluent pollutant concentrations around the LTA. It is therefore a measure of extreme effluent concentration levels compared to the mean concentration values.

The US EPA has developed models to calculate the variability factors for daily maximum  $VF_1$  and monthly mean  $VF_4$ . The variability factors thus calculated are unitless and can be averaged across all plants within a sector to yield the sector specific variability factor for a pollutant of interest.

### **Concentration Variability Factors**

The third step in the effluent limits setting process was to calculate concentration variability factors that take into account analytical and sampling uncertainty, process and plant variations, treatment process fluctuations and operational changes in the treatment system.

The daily variability factor,  $VF_1$ , is used to set daily maximum performance values and is calculated as the ratio of the 99th percentile of the data to the expected mean based on the distribution of the data.

The monthly variability factor,  $VF_4$ , is used to set monthly average performance values and is calculated as the ratio of the 95th percentile of the data to the expected mean based on the distribution of the data.

Table 5.2 lists the long term average concentration, the daily and monthly variability factors for suspended solids at the nine "Best Plants". As the average suspended solids values at Timminco Ltd. and Luzenac Inc. were lower than the suspended solids regulation method detection level of 5 mg/L, data from these two plants were not considered further for limits setting.

**TABLE 5.2 : LONG-TERM AVERAGE AND VARIABILITY FACTORS: TOTAL SUSPENDED SOLIDS**

Company	LTA	VF <sub>1</sub>	VF <sub>4</sub>
Lafarge Canada, Bath	10.60	7.10	2.43
Guelph Dolime	8.38	8.53	2.69
Steetley Quarry Products	11.25	3.10	1.57
Stelco Inc.	7.02	3.31	1.60
Timminco Ltd.	3.40	2.19	1.27
Westroc Industries Ltd.	10.48	6.29	2.25
Canada Talc Ltd.	9.41	7.51	2.49
Cal Graphite Corp.	11.30	5.05	1.96
Luzenac Inc.	3.69	7.87	1.88
<b>Average</b>	<b>8.39</b>	<b>5.66</b>	<b>2.02</b>

**BAT Performance Values : Daily and Monthly Concentration Limits**

The average best performance values were used to set daily and monthly concentration limits for all the sector plants. For each of the seven plants, the product of the LTA and the daily or monthly variability factor is the daily or monthly limit. The average LTA and variability factors form the basis of the sector-wide limits for TSS, Table 5.3.

**TABLE 5.3: DAILY/MONTHLY CONCENTRATION LIMITS in mg/L TSS**

Company	Daily Limit	Monthly Limit
Lafarge Canada, Bath	75.26	25.76
Guelph Dolime	71.40	22.51
Steetley	34.88	17.66
Stelco Inc.	23.24	11.23
Westroc Industries	65.92	23.58
Canada Talc Ltd.	70.67	23.43
Cal Graphite Corp.	57.07	22.15
<b>Average</b>	<b>56.9</b>	<b>20.9</b>

Based on the performance data for the seven best plants, the monthly and daily TSS limits were calculated to be 21 mg/L and 57 mg/L respectively.

### Ministry and Industry Review

The limit setting exercise for the sector was performed at the JTC level due to the ministry accelerated program for the completion of the limits regulation for the Industrial Minerals sector.

The calculated daily TSS limit of 57 was rounded off to 50 mg/L. This daily limit was accepted by both ministry and industry at the JTC level.

The BAT consultant selected Lafarge Exshaw cement plant in Alberta as the Global BAT plant for the cement category. Since cement forms a major category in the Industrial Minerals sector, data from the global BAT plant were evaluated. The total suspended solids data collected for the period of August 1, 1990 to July 31, 1991 (ie. MISA monitoring period) and reported to the Alberta Environment, were used for the analysis. The TSS concentration performance values are shown in Table 5.4.

**TABLE 5.4: TOTAL SUSPENDED SOLIDS CONCENTRATION  
PERFORMANCE VALUES FOR LAFARGE EXSHAW CEMENT PLANT  
(ALL DATA)**

LTA	10.38 mg/L
VF <sub>1</sub>	6.755
VF <sub>4</sub>	2.36
Daily Limit	69.8 mg/L
Monthly Limit	24.5 mg/L

The analysis indicates a value of 25 mg/L as the monthly TSS limit for the global cement BAT plant.

In addition to the information provided by analyzing the data from the Global BAT plant, published information supports setting monthly limit for the sector plants at 25 mg/L. According to the US EPA, suspended solids concentration up to 25 mg/L from non-metallic minerals and structural material operations offers high level of protection to aquatic communities<sup>2</sup>. In addition, the Ministry's publication on guidelines for lake filling in Ontario states that the generally accepted suspended solids "no effect" level on biota is 25 mg/L<sup>3</sup>.

Economic assessment analyses were done to provide input into the limit setting process. The limits options examined and the contaminant removals are listed in Table 5.5.

**TABLE 5.5 : LIMIT OPTIONS**

Option	TSS Concentration	% TSS Removal
Option 1	25 mg/L	57.2%
Option 2	15 mg/L	77.4%
Option 3	0 mg/L	100.0%

The contaminant removal represents the incremental reduction of loadings with the limit option in comparison with the 1990-1991 (MISA monitoring data) loadings.

Cost estimates were generated on a plant by plant basis for the sector. Financial and economic assessments were carried out. Abatement cost functions were developed for the limit options in order to show the relationship between different levels of contaminant removal and the minimum cost of achieving them. Details of the economic analyses are provided in the economic assessment report for the industrial minerals sector<sup>4</sup>.

The results of the cost-effectiveness analysis indicate that Option 1 (Maximum Monthly Average of 25 mg/L of TSS) is associated with the lowest annualized cost for the sector and is the most cost-effective option. The estimated costs per kilogram of TSS removed, for the 25 firms for which data was available, are \$1.86, \$37.25 and \$290.93, for Options 1, 2 and 3, respectively. Both government and industry agreed with the selection of Option 1 for the sector plants.

#### **5.4 EXEMPTION OF PITS AND QUARRIES**

There are over three thousand pits and quarries in the Province of Ontario. Most of these operations are dry and do not discharge wastewater, especially plants in the sand and gravel category. In addition, five sand and gravel pits that have washing facilities, recycle their effluent. Approximately eighty-one pits and quarries discharge effluents to surface water courses.

The monitoring results confirmed that:

- effluents were non-toxic to rainbow trout and Daphnia magna
- no persistent toxic chemicals were found in the effluents discharged from these properties
- the suspended solids within the subsector are composed of ground-up sand and limestone.

In summary, the wastewater effluents from plants in this subsector do not appear to have a significant environmental impact.

Pits and quarries have been exempted from the regulation. Consideration is being given to the application of other Ministry control instruments for effluent discharges from these plants.

With respect to this Regulation, two types of pits and quarries are recognised; those associated with manufacturing facilities and stand-alone pits and quarries.

Stand-alone pit means land or land under water, which is not on the developed property associated with an operating industrial mineral manufacturing facility, from which sand or gravel is excavated. Stand-alone quarry means land or land under water, which is not on the developed property associated with an operating industrial mineral manufacturing facility, from which limestone, dolomite or sandstone is excavated.

It must be noted that pits and quarries on the developed properties of manufacturing facilities like cement plants are not exempted from the regulation.

#### **5.5 EXEMPTION OF CLAY AND SHALE PITS**

In general, plants in the Industrial Minerals Sector do not have a separate collection system for storm water. Consequently storm water is usually included as a component of one of the other effluent streams. During the monitoring period, it was found that the clay and shale pits that were

monitored discharged only storm water effluent. The discharges were not toxic to rainbow trout or Daphnia magna.

The Ministry made a policy decision that plants discharging storm water only will not be regulated under the MISA effluent limits regulations. Instead, they will be regulated under other Ministry control instruments such as Certificates of Approval or Control Orders. Thus plants in the clay and shale category that discharge storm water only are exempted from this regulation.

## **5.6 OVERALL IMPLICATIONS OF THE EFFLUENT LIMITS REGULATION**

All process effluents in the industrial minerals sector are required to be non-toxic to rainbow trout and Daphnia magna.

The regulation requires the pH of effluents to be between the range of 6.0 and 9.5.

Loadings reductions, as indicated in Table 5.5, on an industry-wide basis are expected as a result of the application of the industrial minerals sector effluent limits regulation.

The following environmental benefits are expected following industry compliance with the proposed effluent limits:

- Some effluents that are currently acutely lethal will be rendered non-acutely lethal to rainbow trout and Daphnia magna. This will protect fish and other forms of aquatic life.
- Reduction of suspended solids will limit degradation of river bottoms which may be currently unsuitable for aquatic life and will reduce deposition on spawning grounds.
- Aesthetic improvements in water and shoreline quality near plant outfalls.
- Turbidity of receiving waters will be decreased enhancing recreational activities.

**5.7 REFERENCES**

1. Ontario Ministry of the Environment (1990). "MISA Issue Resolution Process Issue Resolution Committee Reports." Toronto, Ontario. ISBN 0-7729-7354-7
2. U. S. Environmental Protection Agency, Report to Congress. "The Effects of Discharges from Limestone Quarries on Water Quality and Aquatic Biota". Publication # PB82-24 220 7, 1982.
3. Ontario Ministry of the Environment (1992). "Fill Quality Guidelines for Lakefilling in Ontario, Application of Sediment and Water Quality Guidelines to Lakefilling". Toronto, Ontario. ISBN
4. Ontario Ministry of the Environment. "MISA Economic Assessment - Potential Pollution Water Pollution Abatement Programs for Ontario Industrial Minerals Sector", Queen's Printer, Toronto, Ontario, 1993.

THE LIMITS REGULATION

CHAPTER 6  
OF THE  
DEVELOPMENT DOCUMENT



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## 6.1 EFFLUENT MONITORING AND EFFLUENT LIMITS

The Effluent Monitoring and Effluent Limits Regulation for the Industrial Minerals Sector establishes the terms and conditions of compliance. The regulation consists of a number of sections which cover interpretation, requirements related to compliance, record keeping, reporting and timing.

### Interpretation

This section provides definitions of terms used in the Regulation in order to clarify the meaning of those terms which may have different interpretations and to explain technical terms which may not be in common usage.

The Regulation applies both to effluent streams that discharge continuously or intermittently.

The Regulation allows the requirements to be discharged by a second party working on behalf of the discharger. The ultimate responsibility is on the discharger.

### Purpose

The purpose of the Regulation is to monitor and control the quality of effluents that are discharged directly to surface watercourses by the Ontario industrial minerals sector. This is done by limiting the concentration of suspended solids in the industrial minerals sector process effluents and by requiring that process effluents in the sector be non-acutely lethal to the aquatic species specified in the Regulation.

Process effluent is defined by the Regulation as an effluent (wastewater stream) which originates from or comes into contact with any industrial process or process materials, blowdown water, effluent that results from cleaning or maintenance operations at a plant during a period when all or part of the plant is shut down. A combination of the above mentioned effluents with storm water effluent or cooling water effluent is process effluent.

The Regulation also requires the monitoring of all cooling water effluent streams, all emergency overflow effluent streams and all salt evaporator plant effluent streams in order to ensure that these streams are not contaminated and acutely lethal to the aquatic species specified in the Regulation. By definition, these effluent streams are not process effluent streams.

### Application

This Regulation applies only with respect to existing and new plants that discharge a total volume of process effluent and cooling water effluent and emergency overflow effluent and salt evaporator plant effluent greater than fifty cubic meters per day.

Stand-alone pits and and stand-alone quarries have been exempted from the regulation. Consideration is being given to the application of other Ministry control instruments for effluent discharges from these plants.

The regulation does not apply to plants that discharge only storm water or to plants that discharge effluent to a municipal sewer.

### Obligations Under Approvals, Orders, etc.

The Regulation shall not be interpreted to limit or reduce a discharger's obligations under an approval, order, direction or any other instrument issued under any Act.

### Non-application of General Effluent Monitoring Regulation

With respect to the General Effluent monitoring regulation, O. Reg. 695/88 as amended to O. Reg. 533/89, this Regulation is not a Sectoral Effluent Monitoring Regulation.

### By-Passes

The Regulation requires that process effluents must be discharged through designated sampling points only, thereby prohibiting by-passes of these effluents.

### Sampling and Analytical Procedures

In order to ensure the accurate sampling and analysis of effluent samples, standard sampling and analytical procedures have been developed by the Ministry. The Ministry protocol on sampling and analysis entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater: Ontario Ministry of Environment and Energy (July 1993)" outlines how a discharger must collect a sample, how the sample should be analyzed and the minimum analytical method detection level that the laboratory must meet when analysing the sample.

For plants that are not in operation for twenty-four hours a day, each discharger may collect composite samples by taking three equal volume grab samples at intervals of at least four hours and combining them. This shall be done over a period equal to or less than twelve hours.

A discharger may collect a single grab sample of the effluent during any twelve hour period for analysis if a calculated retention time of a waste treatment facility in relation to a process effluent is two days or more.

Each discharger shall maintain the sampling equipment used at the discharger's plant for sampling required by this Regulation in a way that ensures that the samples collected at the plant under this Regulation accurately reflect the level of discharge of each limited parameter and assessment parameter from the plant.

## 6.2 SAMPLING POINTS

### Establishment and Elimination of Sampling Points

A discharger shall within ninety days after the Regulation is filed, establish sampling points on all process effluent streams, cooling water effluent streams, emergency overflow effluent streams and salt evaporator plant effluent streams. The sampling point location must be representative of the effluent. All samples collected for the Regulation must be taken from the designated sampling points.

If the effluent concentration or the plant loadings are significantly affected by dilution or masking, a new sampling point shall be established within thirty days of the change.

### Reports on Sampling Points

100 days after which the regulation is filed, the discharger shall submit to the Director a list and plot plan showing the sampling points established at the discharger's plant.

A discharger shall inform the Director within thirty days after establishing a new sampling point with a revised list and plot plan showing the new sampling point. This also applies to the elimination of sampling points. A written notice describing where the old sampling point used to be, together with a revised list and a plot plan without the sampling point must be submitted within thirty days after eliminating the sampling point.

## 6.3 CALCULATION OF LOADINGS

Loadings are not limited within the Regulation. The Regulation, however, does require that loadings be calculated and reported.

The following rules must be observed when calculating parameter loadings:

- The actual analytical result obtained by the laboratory shall be used by the discharger.

- If the actual analytical result is less than one-tenth of the analytical method detection limit set out in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" dated July, 1993, the discharger shall use the value zero for the purpose of performing calculations.

Daily effluent stream loading, a daily effluent plant loading and a monthly average effluent plant loading shall be calculated for process effluent stream, cooling water effluent stream and salt evaporator plant effluent stream. Daily plant loadings shall be calculated for emergency overflow effluent stream whenever it occurs. The calculations shown below are applicable to all other effluent stream types.

The daily process effluent stream loading, in kilograms, is calculated by multiplying, with necessary adjustments of units, the analytical result obtained from the sample for the parameter by the daily volume of effluent.

The daily process effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily process effluent stream loadings for the parameter.

A monthly average process effluent plant loading for a parameter for a month is the arithmetic mean of the daily process effluent plant loadings for the parameter calculated above for the month.

#### **Calculation of Concentration**

In order to determine compliance with the monthly average concentration for process effluent, a monthly average concentration, in milligrams per litre, shall be calculated for each limited parameter.

A monthly average concentration is calculated by taking the arithmetic average of the daily concentrations of the weekly samples that are required by the Regulation throughout the month.

A monthly average concentration shall also be calculated for cooling water effluent, salt evaporator plant effluent and emergency overflow effluent. No calculation is required for emergency overflow effluent if there is no discharge.

#### **Calculation of Retention Time - Process Effluent**

The Regulation allows the collection of a single grab sample instead of composite sample of process effluent if the calculated retention time is two days or more.

A discharger shall calculate a retention time, in days, for a process effluent stream by dividing the available total volume of a waste treatment facility by the average daily volume of effluent

in that process effluent stream, with suitable adjustment in units to yield a result in days.

The average daily volume of a process effluent is the average of thirty daily volumes determined for that effluent in any quarter during which the plant is in operation.

#### 6.4 PARAMETER AND LETHALITY LIMITS

##### Parameter Limits

- Daily Concentration Limits  
A plant must not exceed the daily concentration limits listed in column 3 of schedule 2 on any operating day.
- Monthly Average Concentration Limits  
A plant must not exceed the monthly average concentration limits listed in column 4 of Schedule 2 during any month of the year.
- pH  
A plant must not discharge a process effluent that has a pH below 6.0 or above 9.5 at any time. Due to site specific requirements, Unimin Canada Ltd., Blue Mountain and Unimin Canada Ltd., Nephton shall control the quality of the process effluent stream at the point of discharge within the range of 6.5 to 8.5.

##### Lethality Limits

- Acute Lethality  
A plant must not discharge a process effluent, a cooling water effluent or a salt evaporator plant effluent that is acutely lethal to either rainbow trout or *Daphnia magna*. An acutely lethal effluent is one that kills more than 50% of the test species in 100% (undiluted) effluent.

#### 6.5 MONITORING

On a day that process effluent is not discharged from a plant, a discharger need not collect samples from any stream.

##### Monitoring - Process Effluent - Weekly

The Ontario industrial minerals sector dischargers must monitor and analyze process effluents for the following parameters:

- pH
- suspended solids

The frequency of monitoring for suspended solids is given in column 2 of schedule 2 of the Regulation. The Regulation requires that composite samples of process effluent be taken unless the calculated retention time is two days or more. In such cases, grab samples may be taken.

For process effluents, suspended solids and pH are monitored on a weekly basis. There shall be an interval of at least four days between successive pick-ups for weekly monitoring.

#### **Monitoring - Process Effluent - Quality Control**

A discharger shall pick up a duplicate sample of each process effluent once a year when the weekly samples are picked up and analyze the sample for total suspended solids.

There shall be an interval of at least six months between successive pick-up days for QA/QC sampling.

#### **Monitoring - Cooling Water and Salt Evaporator Plant Effluents**

Cooling water and salt evaporator plant effluents are monitored weekly for suspended solids.

#### **Monitoring - Emergency Overflow Effluents**

Emergency overflow effluents are monitored daily for suspended solids whenever emergency overflow occurs.

#### **Monitoring - Acute Lethality Testing - Rainbow Trout and Daphnia Magna**

During the first year that the Regulation is in effect, each discharger is required to conduct monthly acute lethality tests in order to determine whether the plant's process effluent, salt evaporator plant effluent or cooling water effluent is acutely lethal to rainbow trout or Daphnia magna. Environment Canada protocols on acute toxicity testing describe the sampling and analytical procedures that have to be followed when conducting the acute lethality tests. These documents are entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout (1990)" and "Biological Test method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna (1990)".

If a plant passes twelve consecutive monthly rainbow trout acute lethality tests and twelve consecutive monthly Daphnia magna acute lethality tests, then the discharger is allowed to monitor acute

lethality on a quarterly basis.

**Monitoring - Chronic Toxicity Testing - Fathead Minnow and Ceriodaphnia dubia**

When a plant passes twelve consecutive monthly rainbow trout acute lethality tests and twelve consecutive monthly Daphnia magna acute lethality tests and begins to perform the tests quarterly, a discharger is required to monitor chronic toxicity to Ceriodaphnia dubia and fathead minnows once every six months. These 7-day tests study Ceriodaphnia dubia reproduction inhibition and survivability and fathead minnow growth inhibition in 100% process effluent.

The discharger shall perform the test according to the procedure described in the Environment Canada publication entitled "Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows" dated February, 1992 and "Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia", dated February, 1992.

Process effluent samples are collected every six months for these tests. There shall be an interval of at least ninety days between successive sample pick-up days.

## **6.6 EFFLUENT VOLUME**

### **Flow Measurement**

Each discharger shall determine, in cubic metres, a daily volume of effluent for each process effluent stream at the discharger's plant.

The flow measurement device must:

- be installed properly and be easily accessible for inspection by a provincial officer and,
- be accurate to within plus or minus 15%

Each discharger shall also determine the flow of cooling water, salt evaporator plant effluent and emergency overflow effluent on the day that the samples are collected. Each flow measurement device must:

- be maintained in the same manner as the process effluent flow measurement devices and,
- be accurate to within plus or minus 20%

### **Calculation of Plant volumes**

A discharger shall calculate, in cubic metres, a daily plant volume of process effluent that is discharged from each process effluent

stream each day that the plant is in operation. The discharger shall also calculate the daily plant volume of cooling water effluent and salt evaporator plant effluent.

At the end of each month, the discharger shall calculate the monthly average volume of effluent discharged during the month by taking the average (arithmetic mean) of the daily plant volumes calculated for the month.

Each discharger shall calculate, in cubic metres, a total emergency overflow effluent plant volume for each day on which an emergency overflow effluent is discharged from the plant.

#### **6.7 STORM WATER CONTROL STUDY**

Each discharger must complete a storm water control study within two years after the Regulation comes into force according to the Ministry of Environment and Energy publication entitled "Protocol For Conducting A Storm Water Control Study (August, 1993)". The discharger may be exempted from a storm water control study if the discharger meets the exemption criteria as set out in the protocol.

If a discharger plans to make process changes, install waste treatment facilities, implement management practices or make other changes that will affect the quality and quantity of storm water discharged from the plant and notifies the Ministry in writing, an additional time will be provided for the completion of the storm water control study.

#### **6.8 RECORDS AND REPORTS**

##### **Record Keeping**

Each discharger shall make each record required by this Regulation as soon as reasonably possible and must keep all records for a period of three years and upon request, make them accessible to the Ministry for inspection.

The following records must be kept:

- all analytical results obtained under monitoring and all calculations performed
- all sampling and analytical procedures used including, for each sample, the date, the time of pick-up and any incidents likely to affect the analytical results
- the results of all quality control monitoring, acute lethality and chronic toxicity testing
- all records of flow measurement as well as records of

maintenance and calibration of flow measuring devices

- all problems of malfunction related to sampling, chemical analysis, acute lethality and chronic toxicity testing and flow measuring devices detailing date and duration of malfunction and remedial action taken
- any by-passes stating the date, duration, cause and nature of each by-pass
- all process changes and redirections of or changes in the character of effluent streams that affect the quality of effluent at any sampling point
- the location of each sampling point established at the discharger's plant.

#### Reports Available to the Public

Each direct discharger shall prepare an annual summary of all test results and calculations (concentration, loadings, flow and toxicity), by-passes and any results that exceeded a limit, on or before the first of June of each year, and make the summary available to the public.

#### Reports to the Director

Each discharger shall notify the Director in writing:

- any change of name or ownership occurring after the day the Regulation comes into force, within thirty days after the end of the month in which the change occurs
- any process change or redirection of or change in the character of an effluent stream over a period greater than one week that affects the quality of effluent at any sampling point within thirty days of the change or redirection
- any concentration, pH, lethality or other result that exceeds a limit prescribed in this Regulation
- any by-passes.

A discharger shall submit a quarterly report both in an electronic format and in hard copy within forty-five days after the end of each quarter:

- the monthly average plant loadings, the highest and lowest daily plant loadings and the monthly average concentration and the highest and lowest daily concentration for the month for each limited parameter and each assessment parameter

- the monthly average process effluent plant volume and the highest and lowest daily process effluent plant volumes for each month in the quarter
- the monthly average cooling water effluent plant volume and the highest and lowest daily cooling water effluent plant volumes for each month in the quarter
- the monthly average salt evaporator plant effluent plant volume and the highest and lowest daily salt evaporator plant effluent plant volumes for each month in the quarter
- the total emergency overflow effluent plant volume for each month in the quarter
- for each month in the quarter, the highest and lowest pH results obtained for each process effluent monitoring stream at the discharger's plant
- for each month in the quarter, the number of days on which process effluent was discharged from the discharger's plant
- a discharger shall report all chronic toxicity test results within 60 days after the semi-annual period for which the samples were collected.

#### 6.9 COMMENCEMENT AND REVOCATION PROVISIONS

Effluent Monitoring Regulation for the Industrial Minerals Sector, Ontario Regulation 91/90 is revoked 90 days after the day on which this regulation is filed.

Parameter and lethality limits come into force on the date that is three years after the day on which this Regulation is filed. Parts V and VI come into force on the date that is 90 days after the day on which this Regulation is filed.

APPENDIX I

THE DRAFT  
EFFLUENT MONITORING AND EFFLUENT LIMITS REGULATION  
FOR THE  
INDUSTRIAL MINERALS SECTOR

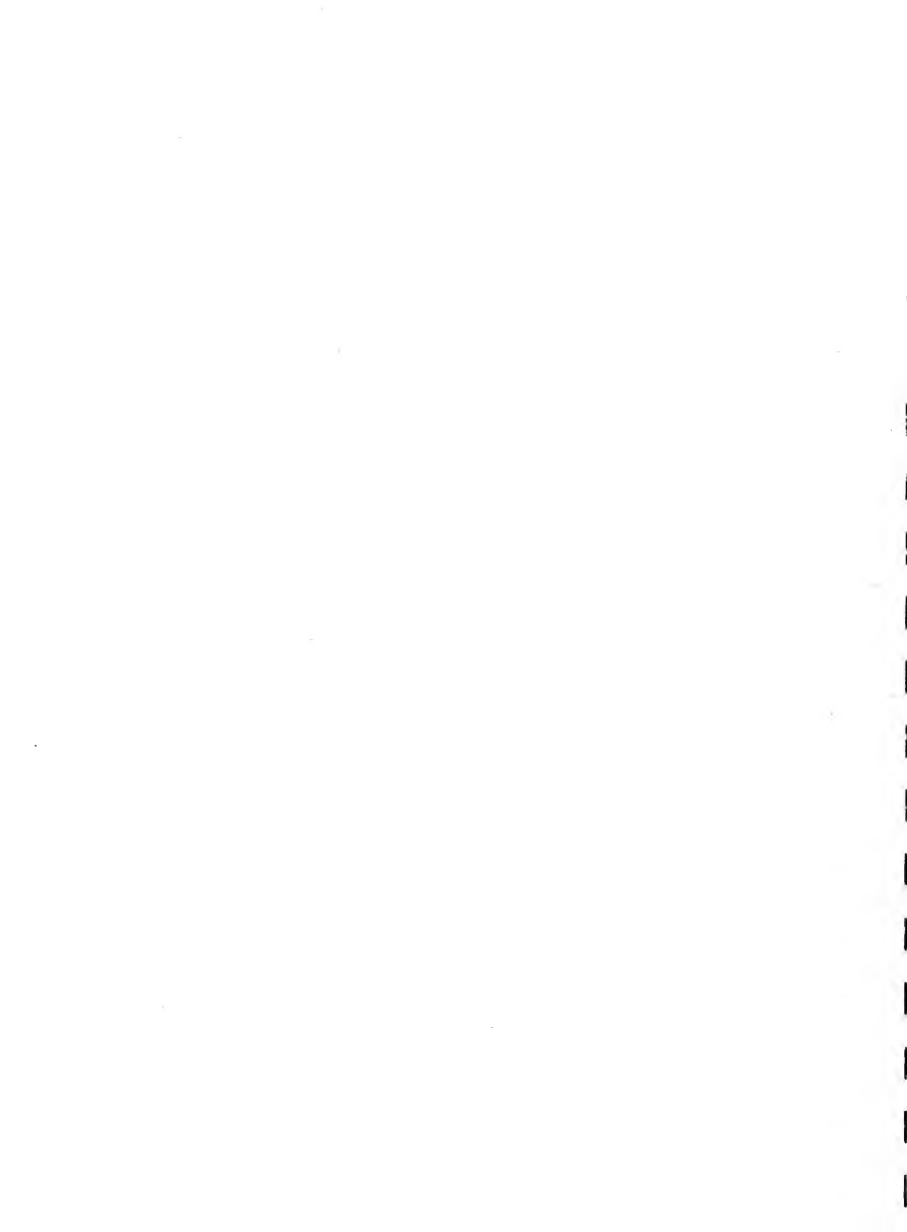


# **ONTARIO REGULATION ???/??**

REGULATION MADE UNDER THE  
ENVIRONMENTAL PROTECTION ACT

## **EFFLUENT MONITORING AND EFFLUENT LIMITS INDUSTRIAL MINERALS SECTOR**

MINISTRY OF ENVIRONMENT AND ENERGY  
OCTOBER 1993



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REGULATION MADE UNDER THE  
ENVIRONMENTAL PROTECTION ACT

EFFLUENT MONITORING AND EFFLUENT LIMITS -

INDUSTRIAL MINERALS SECTOR

PART I -GENERAL

Interpretation

1.-(1) In this Regulation,

"assessment parameter" means a parameter that is listed in Schedule 3 or 4;

"blowdown water" means recirculating water that is discharged from a cooling water system for the purpose of controlling the level of water in the cooling water system or for the purpose of discharging from the cooling water system materials contained in the cooling water system the further build-up of which would impair the operation of the system;

"cooling water effluent" means water and associated material that is used in an industrial process for the purpose of removing heat and that has not, by design, come into contact with process materials, but does not include blowdown water ;

"cooling water effluent monitoring stream" means a cooling water effluent stream on which a sampling point is established under section 8;

"cooling water effluent sampling point" means a sampling point established on a cooling water effluent stream under section 8;

"Director", in relation to obligations of a discharger, means a Director appointed under section 5 of the Act and responsible for the region in which the discharger's plant is located and includes an alternate named by the Director;

"discharger" means an owner or person in occupation or having the charge, management or control of a plant to which this Regulation applies;

"emergency overflow effluent" means an effluent discharged through an engineered structure that has been designed to protect waste disposal facilities from catastrophic failure, and is not considered to be a process effluent;

"emergency overflow effluent monitoring stream" means an emergency overflow effluent stream on which a sampling point is established under section 8;

"emergency overflow effluent sampling point" means a sampling point established on an emergency overflow effluent stream under section 8;

"industrial mineral" means calcite, graphite, gypsum, quartzite, salt, talc, nepheline syenite, basalt, traprock, sand, gravel, limestone, dolomite, sandstone or any combination thereof and includes the following manufactured products: portland clinker, cement, lime, magnesium, strontium and calcium.

"limited parameter", in relation to a plant, means a parameter for which a limit is specified for the plant in column 3 or 4 of Schedule 2;

"mine" means any opening or excavation in, or working of the ground, for the purpose of winning calcite, graphite, gypsum, quartzite, salt, talc, nepheline syenite, basalt or traprock and all ways, works, machinery, plant, buildings and premises below or above the ground belonging to or used in connection with such activity, and any furnace, concentrator, evaporator, mill, work or place used for or in connection with washing, crushing, grinding, sifting, filtering, calcining, drying or treating of such substances;

"operating industrial mineral manufacturing facility" means a plant producing portland clinker, cement, lime, magnesium, calcium or strontium;

"operating industrial mineral mine" means a mine that is producing calcite, graphite, gypsum, quartzite, salt, talc, nepheline syenite, basalt or traprock;

"pick-up", in relation to a sample, means pick-up for the purpose of transportation to and analysis at a laboratory;

"plant" means an operating industrial mineral mine or an operating industrial mineral manufacturing facility and the developed property, waste disposal sites and wastewater treatment facilities associated with it;

"process change" means a change in equipment, production processes, process materials or treatment processes;

"process effluent" means,

- (a) effluent that, by design, has come into contact with process materials,
- (b) blowdown water,
- (c) effluent that results from cleaning or maintenance

operations at a plant during a period when all or part of the plant is shut down, and

- (d) any effluent described in clauses (a) to (c) combined with cooling water effluent or storm water effluent but does not include salt evaporator plant effluent;

"process effluent monitoring stream" means a process effluent stream on which a sampling point is established under section 8;

"process effluent sampling point" means a sampling point established on a process effluent stream under section 8;

"process materials", in relation to a discharger's plant, means raw materials for use in an industrial process at the plant, manufacturing intermediates produced at the plant, or products or by-products of an industrial process at the plant, but does not include chemicals added to cooling water for the purpose of controlling organisms, fouling and corrosion;

"quarter" means all or part of a period of three consecutive months beginning on the first day of January, April, July or October;

"salt" means sodium chloride or halite;

"salt evaporator plant effluent" means water and associated material that is discharged from a salt evaporator plant;

"salt evaporator plant effluent monitoring stream" means a salt evaporator effluent stream on which a sampling point is established under section 8;

"salt evaporator plant effluent sampling point" means a sampling point established on a salt evaporator plant effluent stream under section 8;

"semi-annual period" means all or part of a period of six months beginning on the first day of January or July;

"stand-alone pit" means land or land under water, which is not on the developed property associated with an operating industrial mineral manufacturing facility, from which sand or gravel is excavated for manufacturing processes;

"stand-alone quarry" means land or land under water, which is not on the developed property associated with an operating industrial mineral manufacturing facility, from which limestone, dolomite or sandstone is excavated for

manufacturing processes;

"storm water effluent" means run-off from a storm event or thaw that is not used in any industrial process.

(2) For greater certainty, this Regulation applies both to effluent streams that discharge continuously and to effluent streams that discharge intermittently.

(3) An obligation on a discharger to do a thing under this Regulation is discharged if another person has done it on the discharger's behalf.

(4) A direct discharger need not collect any sample required to be collected by this Regulation if to do so would result in extraordinary danger to health or safety.

#### Purpose

2. The purpose of this Regulation is to monitor and control the quality of effluent discharged from the plants listed in Schedule 1.

#### Application

3.-(1) This Regulation applies only with respect to the plants listed in Schedule 1.

(2) This Regulation applies only with respect to existing and new plants that discharge a total volume of process effluent and cooling water effluent and emergency overflow effluent and salt evaporator plant effluent of more than fifty cubic meters per day.

(3) This Regulation does not apply with respect to stand-alone pits or to stand-alone quarries.

(4) This regulation does not apply with respect to plants that discharge only stormwater.

(5) This Regulation does not apply with respect to the discharge of effluent to a municipal sewer.

#### Obligations Under Approvals, Orders, etc.

4. Nothing in this Regulation shall be interpreted to limit or reduce a discharger's obligations under an approval, order, direction or other instrument issued under any Act.

## Non-application of General Effluent Monitoring Regulation

5. This Regulation is not a Sectoral Effluent Monitoring Regulation within the meaning of Ontario Regulation 695/88.

### By-passes

6. Beginning on ....., 199., a discharger shall not permit process effluent to be discharged from the discharger's plant unless the process effluent flows past a sampling point established on a process effluent stream in accordance with this Regulation before being discharged.

(The date on which Part IV of this Regulation comes into force will be inserted in section 6.)

## Sampling and Analytical Procedures

7.-(1) Each discharger shall carry out the establishment of sampling point obligations of this Regulation and the sampling and analysis obligations of this Regulation, including quality control sampling and analysis obligations, in accordance with the procedures described in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/ Municipal Wastewater", dated July, 1993.

(2) Despite subsection (1), over a period equal to or less than twelve hours, each discharger may collect composite samples by taking three equal volume grab samples at intervals of at least four hours and combining them.

(3) Despite subsection (1), a discharger may collect on any day, a single grab sample from a process effluent stream provided that the retention time calculated for that stream in accordance with section 12.2, is greater than two days.

(4) Each discharger shall maintain the sampling equipment used at the discharger's plant for sampling required by this Regulation in a way that ensures that the samples collected at the plant under this Regulation accurately reflect the level of discharge of each limited parameter and assessment parameter from the plant.

## PART II - SAMPLING POINTS

### Establishment and Elimination of Sampling Points

8.-(1) Each discharger shall, by ..... .., 199.. establish a sampling point on each process effluent stream,

cooling water effluent stream, salt evaporator plant effluent stream and emergency overflow effluent stream at the discharger's plant, as necessary so that the monthly average concentrations calculated under sections 12 and 13 accurately reflect the level of discharge of each limited parameter and assessment parameter from the plant.

(The date that is 90 days after the day on which this Regulation is filed will be inserted in subsection 8(1).)

(2) If circumstances change so that a new sampling point is necessary at a discharger's plant in order to permit the calculation of plant loadings under sections 12 and 13 for each limited parameter and assessment parameter and the determination of concentrations that accurately reflect the level of discharge of each parameter from the plant, the discharger shall, within thirty days of the change, establish the new sampling point.

(3) A discharger may eliminate a sampling point established under subsection (1) or (2) if the sampling point is no longer necessary to permit the calculation of plant loadings under sections 12 and 13 for each limited parameter and assessment parameter and the determination of concentrations that accurately reflect the level of discharge of each parameter from the plant.

(4) For the purposes of this section, a plant loading for a parameter or a concentration for a parameter that is based on analytical results that are significantly affected by dilution or masking due to the merging of streams upstream of a sampling point at a plant is not a loading or a concentration that accurately reflects the level of discharge of the parameter from the plant.

(5) In determining what is necessary to meet a discharger's obligations to establish sampling points under this section, the discharger shall consider both which streams should have sampling points and where on a stream a sampling point should be located.

#### Reports on Sampling Points

9.-(1) By ..... , 199., each discharger shall submit to the Director a list and plot plan showing the sampling points established under this Regulation at the discharger's plant as of ..... , 199..

(The date that is 100 days after the day on which this Regulation is filed will be inserted in the first line of subsection 9(1). The date that is 90 days after the day on which this Regulation is filed will be inserted in the fourth line of subsection 9(1).)

(2) Within thirty days after establishing a sampling point

under this Regulation that is not shown on a list and plot plan submitted under this section, the discharger shall give the Director a written notice describing the location of the sampling point, together with a revised list and plot plan showing the sampling point.

(3) Within thirty days after eliminating a sampling point under this Regulation that is shown on a list and plot plan submitted under this section, the discharger shall give the Director a written notice describing where the sampling point used to be, together with a revised list and plot plan without the sampling point.

#### Use of Sampling Points Established Under This Part

10. Subject to section 19, each discharger shall use the sampling points established under this section for all sampling required by this Regulation.

### PART III - CALCULATION OF LOADINGS

#### Calculation of Loadings- General

11.-(1) For the purposes of performing a calculation under sections 12 and 13, a discharger shall use the actual analytical result obtained by the laboratory.

(2) Despite subsection (1), where the actual analytical result is less than one-tenth of the analytical method detection limit set out in the Ministry of Environment and Energy publication entitled "Protocol for the Sampling and Analysis of Industrial/Municipal Wastewater" dated July, 1993, the discharger shall use the value zero for the purpose of performing a calculation under sections 12 and 13.

(3) Each discharger shall ensure that each calculation of a process effluent loading required by section 12 is performed as soon as reasonably possible after the analytical result on which the calculation is based becomes available to the discharger.

(4) Each discharger shall ensure that each calculation of a cooling water effluent loading, salt evaporator plant effluent loading and emergency overflow effluent loading required by section 13 is performed in time to comply with subsection 31(4).

#### Calculation of Loadings - Process Effluent

12.-(1) Each discharger shall calculate, in kilograms, a daily process effluent stream loading for each limited parameter in each process effluent monitoring stream of the discharger for

each day on which a sample is collected under this Regulation from the stream for analysis for the parameter.

(2) When calculating a daily stream loading under subsection (1), the discharger shall multiply, with the necessary adjustment of units to yield a result in kilograms, the analytical result obtained from the sample for the parameter by the daily volume of effluent, as determined under section 24, for the stream for the day.

(3) Each discharger shall calculate, in kilograms, a daily process effluent plant loading for each limited parameter for each day for which the discharger is required to calculate a daily process effluent stream loading for the parameter under subsection (1).

(4) For the purposes of subsection (3), a daily process effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily process effluent stream loadings for the parameter calculated under subsection (1) for the day.

(5) Where a discharger calculates only one daily process effluent stream loading for a parameter for a day under subsection (1), the daily process effluent plant loading for the parameter for the day for the purposes of subsection (3) is the single daily process effluent stream loading for the parameter for the day.

(6) Each discharger shall calculate, in kilograms, a monthly average process effluent plant loading for each limited parameter for each month in which a sample is collected under this Regulation more than once from a process effluent monitoring stream at the discharger's plant for analysis for the parameter.

(7) For the purposes of subsection (6), a monthly average process effluent plant loading for a parameter for a month is the arithmetic mean of the daily process effluent plant loadings for the parameter calculated under subsection (3) for the month.

#### Calculation of Concentration - Process Effluent

12.1-(1) For each process effluent monitoring stream at a discharger's plant, each discharger shall calculate the average monthly concentration in milligrams per litre for each of the parameters for which a limit is set in column 4 of schedule 2, as soon as is reasonably possible.

(2) When calculating a monthly average concentration under subsection (1), a direct discharger shall take the arithmetic mean of the daily concentrations for samples collected under subsection 17(1) throughout the month.

#### Calculation of Retention Time - Process Effluent

12.2-(1) For the purposes of subsection 7.(3), a discharger shall calculate a retention time, in days, for a process effluent stream by dividing the available total volume of a waste treatment facility by the average daily volume of effluent in that process effluent stream, with suitable adjustment in units to yield a result in days.

(2) For the purposes of subsection (1), the average daily volume of a process effluent is the average of thirty daily volumes determined for that effluent in accordance with Part VI.

#### Calculation of Loadings - Cooling Water, Salt Evaporator Plant Effluent and Emergency Overflow Effluent

13.-(1) Each discharger shall calculate, in kilograms, a daily cooling water effluent stream loading for each assessment parameter in each cooling water effluent monitoring stream of the discharger for each day on which a sample is collected under this Regulation from the stream for analysis for the parameter.

(2) When calculating a daily stream loading under subsection (1), the discharger shall multiply, with the necessary adjustment of units to yield a result in kilograms, the analytical result obtained from the sample for the parameter by the daily volume of effluent, as determined under section 24, for the stream for the day.

(3) Each discharger shall calculate, in kilograms, a daily cooling water effluent plant loading for each assessment parameter for each day for which the discharger is required to calculate a daily cooling water effluent stream loading for the parameter under subsection (1).

(4) For the purposes of subsection (3), a daily cooling water effluent plant loading for a parameter for a day is the sum, in kilograms, of the daily cooling water effluent stream loadings for the parameter calculated under subsection (1) for the day.

(5) Where a discharger calculates only one daily cooling water effluent stream loading for a parameter for a day under subsection (1), the daily cooling water effluent plant loading for the parameter for the day for the purposes of subsection (3) is the single daily cooling water effluent stream loading for the parameter for the day.

(6) Each discharger shall calculate, in kilograms, a

monthly average cooling water effluent plant loading for each assessment parameter for each month in which a sample is collected under this Regulation more than once from a cooling water effluent monitoring stream at the discharger's plant for analysis for the parameter.

(7) For the purposes of subsection (6), a monthly average cooling water effluent plant loading for a parameter for a month is the arithmetic mean of the daily cooling water effluent plant loadings for the parameter calculated under subsection (3) for the month.

(8) Subsections (1) to (7) apply with necessary modifications to salt evaporator plant effluent monitoring streams and to emergency overflow effluent monitoring streams.

#### Calculation of Concentration - Cooling Water, Salt Evaporator Plant Effluent and Emergency Overflow Effluent

13.1-(1) For each cooling water effluent monitoring stream at a discharger's plant, each discharger shall calculate the average monthly concentration, in milligrams per litre, for each assessment parameter as listed in schedule 3, as soon as is reasonably possible.

(2) When calculating a monthly average concentration under subsection (1), a direct discharger shall take the arithmetic mean of the daily concentrations for samples collected under subsection 23(1) throughout the month.

(3) Subsections (1) and (2) apply with necessary modifications to salt evaporator plant effluent monitoring streams.

(4) Subsections (1) and (2) apply with necessary modifications to emergency overflow effluent monitoring stream for the assessment parameter listed in schedule 4.

### PART IV - PARAMETER AND LETHALITY LIMITS

#### Parameter Limits

14.-(1) Each direct discharger shall ensure that the daily concentration limits for process effluents, listed in column 3 of schedule 2 for a discharger's plant, shall not be exceeded for any operating day.

(2) Each direct discharger shall ensure that the monthly average concentration limits for process effluents, listed in column 4 of schedule 2 for a discharger's plant, shall not be exceeded for any month.

(3) Subject to subsection (4), each discharger shall control the quality of each process effluent monitoring stream at the discharger's plant to ensure that the pH value of any sample collected at a process effluent sampling point at the plant is within the range of 6.0 to 9.5.

(4) Throughout any day on which a discharger has used an alternate sampling point on a process effluent monitoring stream for sampling required by section 19, as permitted by subsections 19(3) and (4), the discharger,

(a) shall control the quality of the stream to ensure that the pH value of any sample collected at the alternate sampling point on the stream is within the range of 6.0 to 9.5; and

(b) need not comply with subsection (3) with respect to the stream.

(5) Despite subsection (3), and subject to subsection (4) Applied Carbon Technology, Inc., Kearney, Unimin Canada Ltd., Blue Mountain and Unimin Canada Ltd., Nephton shall control the quality of each process effluent monitoring stream to ensure that the pH value of any sample collected at a process effluent sampling point is within the range of 6.5 to 8.5.

(5.1) Despite subsection (4) Applied Carbon Technology, Inc., Kearney, Unimin Canada Ltd., Blue Mountain and Unimin Canada Ltd., Nephton shall control the quality of each process effluent monitoring stream to ensure that the pH value of any sample collected at an alternate sampling point on the stream is within the range of 6.5 to 8.5.

#### Lethality Limits

15. Each discharger shall control the quality of each process effluent monitoring stream, each cooling water effluent monitoring stream and each salt evaporator plant effluent monitoring stream at the discharger's plant to ensure that each rainbow trout acute lethality test and each Daphnia magna acute lethality test performed on any grab sample collected at a process effluent sampling point, cooling water effluent sampling point or salt evaporator plant effluent sampling point at the plant results in mortality for no more than fifty percent of the test organisms in one-hundred percent effluent.

## PART V - MONITORING

## Monitoring - General

16.-(1) Despite sections 17 to 23, a discharger need not collect samples from any stream at the discharger's plant on a day on which there is no process effluent that is being discharged from the plant.

(2) Where a discharger is required by this Regulation to pick-up a set of samples and analyze it for certain parameters the discharger shall pick-up a set of samples sufficient to allow all the analyses to be performed.

(3) A discharger shall use all reasonable efforts to ensure that all analyses required by this Regulation are completed as soon as reasonably possible and that the results of those analyses are made available to the discharger as soon as reasonably possible.

(4) Subject to subsection (5), each discharger shall pick-up all sets of samples required to be picked up at the discharger's plant under section 17 between the hours of 7.00 a.m. and 10.00 a.m..

(5) If the Director is satisfied, on the basis of written submissions from a discharger, that the circumstances at the discharger's plant are such that it would be impractical to pick-up a set of samples from each sampling point established at the plant under this Regulation within the time period specified in subsection (4), the Director may give the discharger a written notice in respect of the plant, varying the time period specified in subsection (4).

(6) Subject to subsections (7) and (8), where a discharger is required by section 17 to pick-up a set of samples the discharger shall pick-up a set collected over the twenty-four hour period immediately preceding the pick-up.

(7) The twenty-four hour period referred to in subsection (6) may be shortened or enlarged by up to three hours to permit a discharger to take advantage of the three hour range specified in subsection (4) or of a different three hour period specified in a notice under subsection (5).

(8) Where a notice has been given under subsection (5) in respect of a plant specifying a time period longer than three hours, the twenty-four hour period referred to in subsection (6) may be shortened or enlarged by up to that longer amount of time to permit the discharger to take advantage of the time period specified in the notice.

(9) If the circumstances at a plant change so that the Director is satisfied that the circumstances described in subsection (5) no longer apply at the plant, the Director may revoke a notice given in respect of a plant under subsection (5) by giving a notice of revocation in writing to a discharger for the plant.

#### Monitoring - Process Effluent - Weekly

17.-(1) Each discharger shall, on one day in each week, pick-up a set of samples collected at each process effluent sampling point at the discharger's plant and shall analyze each set of samples for the parameters for which the frequency of monitoring, as set out in column 2 of Schedule 2 for the discharger's plant, is weekly.

(2) There shall be an interval of at least four days between successive pick-up days at the plant under subsection (1).

(3) All samples picked up under subsection (1) in a week shall be picked up on the same day in the week.

#### Monitoring - Process Effluent - Quality Control

18.-(1) On one day in each year after 1993, on a day on which samples are picked up at the plant under subsection 17(1), each discharger shall collect and pick-up a duplicate sample for each sample picked up on that day under subsection 17(1) at one process effluent sampling point at the discharger's plant and shall analyze each duplicate sample for the parameters for which the frequency of monitoring, as set out in column 2 of Schedule 2 for the discharger's plant, is weekly.

(2) There shall be an interval of at least six months between successive pick-up days at the plant under subsection (1).

#### Monitoring - Process Effluent - pH Measurement

19.-(1) Each discharger shall, on one day of the week during the time period applicable to the plant under subsection 16(4) or (5), collect a single grab sample from each process effluent monitoring stream at the discharger's plant and shall analyze each sample for the parameter pH.

(2) Each grab sample collected under subsection (1) shall be picked up within twenty-four hours of when it was collected.

(3) For the purposes of this section, a discharger shall

use either the sampling point established under section 8 on the stream or an alternate sampling point located downstream of the sampling point but before the point of discharge of the stream to surface water or to an industrial sewer used in common with another plant.

(4) Before using an alternate sampling point under subsection (3), a discharger shall give the Director a written notice describing the location of the alternate sampling point, together with a revised version of the list and plot plan submitted under section 9 showing the alternate sampling point.

#### Monitoring - Acute Lethality Testing - Rainbow Trout

20.-(1) Where a discharger is required by this section to perform a rainbow trout acute lethality test, the discharger shall perform the test according to the procedures described in the Environment Canada publication entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout", dated July, 1990.

(2) Each rainbow trout acute lethality test required by this section shall be carried out as a single concentration test using one hundred percent effluent.

(3) On one day in each month, on a day on which samples are picked up at the plant under subsection 17(1), each discharger shall collect and immediately pick-up a grab sample at each process effluent sampling point at the discharger's plant and shall perform a rainbow trout acute lethality test on each sample.

(4) There shall be an interval of at least fifteen days between successive pick-up days at the plant under subsection (3).

(5) All samples picked up under subsection (3) in a month shall be picked up on the same day in the month.

(6) Where a discharger has performed tests under subsection (3) for twelve consecutive months on samples collected from the same sampling point and the mortality of the rainbow trout in each test did not exceed fifty percent, the discharger is relieved of the obligations under subsection (3) relating to the sampling point and shall instead collect and immediately pick-up a grab sample at the sampling point on one day in each quarter and perform a rainbow trout acute lethality test on each sample.

(7) Samples picked up at a plant under subsection (6) shall be picked up on a day on which samples are picked up at the plant under subsection (3).

(8) If no samples are being picked up at a plant under subsection (3) during a quarter, samples picked up at the plant during the quarter under subsection (6) shall be picked up on a day on which samples are picked up at the plant under subsection 17(1).

(9) There shall be an interval of at least forty-five days between successive pick-up days at the plant under subsection (6).

(10) All samples picked up under subsection (6) in a quarter shall be picked up on the same day in the quarter.

(11) If a rainbow trout acute lethality test performed under subsection (6) on any sample from a sampling point results in mortality of more than fifty percent of the test rainbow trout, subsections (6) to (10) cease to apply in respect to samples from that sampling point, and a discharger shall instead comply with the requirements of subsection (3) relating to the sampling point, until the tests performed under subsection (3) on all samples collected from the sampling point for a further twelve consecutive months result in mortality for no more than fifty percent of the rainbow trout for each test.

(12) A discharger shall notify the Director in writing of any change in the frequency of acute lethality testing under this Regulation at the discharger's plant, within thirty days after the day on which the change begins.

(13) A discharger may notify the Director in writing of any period in which the testing of samples collected at a sampling point under subsection (3) would always result in mortality of more than fifty percent of the test rainbow trout.

(14) Where a notice is given under subsection (13), a discharger is relieved of the obligations under subsection (3) relating to the sampling point during the period in which the testing of samples collected at the sampling point would always result in mortality of more than fifty percent of the test rainbow trout.

(15) Subsections (13) and (14) are revoked on .....

**(The date on which Part IV of this Regulation comes into force will be inserted in subsection 20(15).)**

(16) Subsections (2) to (15) apply with necessary modifications to each cooling water effluent sampling point and to each salt evaporator plant effluent sampling point and, for the purpose, the reference in subsection (3) to each process effluent sampling point shall be deemed to be a reference to each cooling water effluent sampling point and to each salt evaporator

plant effluent sampling point and the reference in subsections (3) and (8) to subsection 17(1) shall be deemed to be a reference to subsection 23(1).

#### Monitoring - Acute Lethality Testing - Daphnia magna

21.-(1) Where a discharger is required by this section to perform a Daphnia magna acute lethality test, the discharger shall perform the test according to the procedures described in the Environment Canada publication entitled "Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna", dated July, 1990.

(2) Subsections 20(2) to (16) apply with necessary modifications to Daphnia magna acute lethality tests and, for the purpose, a reference to rainbow trout shall be deemed to be a reference to Daphnia magna.

(3) Each discharger shall pick-up each set of samples required to be collected from a sampling point at the discharger's plant under this section on a day on which the discharger collects a sample from the sampling point under section 20, to the extent possible having regard to the frequency of monitoring required at the sampling point under this section and section 20.

#### Monitoring - Chronic Toxicity Testing - Fathead Minnow and Ceriodaphnia dubia

22.-(1) Where a discharger is required to perform a 7-day fathead minnow growth inhibition test, the discharger shall perform the test according to the procedure described in the Environment Canada publication entitled "Biological Test Method: Test of Larval Growth and Survival Using Fathead Minnows" dated February, 1992.

(2) Where a discharger is required to perform a 7-day Ceriodaphnia dubia reproduction inhibition and survivability test, the discharger shall perform the test according to the procedure described in the Environment Canada publication entitled "Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia", dated February, 1992.

(3) On one day in each semi-annual period, on a day on which samples are picked up at the plant under subsection 17(1), each discharger shall collect and immediately pick-up a grab sample from each process effluent sampling point at the discharger's plant, and shall perform a 7-day fathead minnow growth inhibition test and a 7-day Ceriodaphnia dubia

reproduction inhibition and survivability test on each sample.

(4) There shall be an interval of at least ninety days between successive pick-up days at the plant under subsection (3).

(5) All samples picked up under subsection (3) in a semi-annual period shall be picked up on the same day in the semi-annual period.

(6) A discharger need not collect a sample from a sampling point in accordance with subsection (3) until twelve consecutive monthly rainbow trout acute lethality tests and twelve consecutive monthly Daphnia magna acute lethality tests performed on samples collected at the sampling point at a discharger's plant result in mortality for no more than fifty percent of the test organisms in one hundred percent effluent.

#### Monitoring - Cooling Water Effluent, Salt Evaporator Plant Effluent and Emergency Overflow Effluent- Weekly Assessment

23.-(1) Each discharger shall, on one day in each week, pick-up a set of samples collected at each cooling water effluent sampling point and at each salt evaporator plant effluent sampling point at the discharger's plant and shall analyze each set of samples for each assessment parameter listed in schedule 3.

(2) There shall be an interval of at least four days between successive pick-up days at the plant under subsection (1).

(3) All samples picked up under subsection (1) in a week shall be picked up on the same day in the week.

(4) Each discharger shall pick-up a set of samples collected at each emergency overflow effluent sampling point whenever an emergency overflow occurs, and shall analyze each set of samples for each assessment parameter listed in schedule 4.

#### PART VI - EFFLUENT VOLUME

##### Flow Measurement.

24.-(1) For the purposes of this section, a volume of effluent for a stream for a day is the volume that flowed past the sampling point established under Part II on the stream during the twenty-four hour period preceding the pick-up of the first sample picked up from the stream for the day.

(2) Each discharger shall determine in cubic metres a daily volume of effluent for each process effluent stream at the discharger's plant for each day on which a sample is collected under this Regulation from the stream.

(3) Despite subsection (2), where a process effluent stream discharges on an intermittent basis, the daily volumes for the stream may be determined either by integration of continuous flowrate measurements or by the summation of individual batch volume measurement.

(4) Each discharger shall use flow measurement methods that allow the volumes for process effluent streams to be determined to an accuracy of within plus or minus fifteen percent.

(5) Each discharger shall determine in cubic metres a daily volume of effluent for each cooling water effluent stream, each salt evaporator plant effluent stream and each emergency overflow effluent monitoring stream at the discharger's plant for each day on which a sample is collected under this Regulation from the stream.

(6) Each discharger shall use flow measurement methods that allow the volumes for cooling water effluent stream, salt evaporator plant effluent stream and emergency overflow effluent monitoring stream to be determined to an accuracy of within plus or minus twenty percent.

(7) Each discharger shall, no later than the day that this section comes into force, determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that each flow measurement method used under subsections (2) and (3) meets the accuracy requirements of subsection (4) and that each flow measurement method used under subsection (5) meets the accuracy requirements of subsection (6).

(8) Where a discharger uses a new flow measurement method or alters an existing flow measurement method, the discharger shall determine by calibration or confirm by means of a certified report of a registered professional engineer of the Province of Ontario that each new or altered flow measurement method meets the accuracy requirements of subsections (4) or (6), as the case may be, within two weeks after the day on which the new or altered method or system is used.

(9) Each discharger shall develop and implement a maintenance schedule and a calibration schedule for each flow measurement system installed at the discharger's plant and shall maintain each flow measurement system according to good operating practices.

(10) Each discharger shall use reasonable efforts to set up each flow measurement system used for the purposes of this section in a way that permits inspection by a provincial officer.

#### Calculation of Plant Volumes

25.-(1) Each discharger shall calculate, in cubic metres, a daily process effluent plant volume for each day.

(2) For the purposes of subsection (1), a process effluent plant volume for a day is the sum of the daily process effluent volumes determined under section 24 for the day.

(3) Each discharger shall calculate, in cubic metres, a monthly average process effluent plant volume for each month, by taking the arithmetic mean of the daily process effluent plant volumes calculated under subsection (1) for the month.

(4) Each discharger shall calculate, in cubic metres, a daily cooling water effluent plant volume for each day.

(5) For the purposes of subsection (4), a cooling water effluent plant volume for a day is the sum of the daily cooling water volumes determined under section 24 for the day.

(6) Each discharger shall calculate, in cubic metres, a monthly average cooling water effluent plant volume for each month, by taking the arithmetic mean of the daily cooling water effluent plant volumes calculated under subsection (4) for the month.

(7) Each discharger shall calculate, in cubic metres, a daily salt evaporator plant effluent plant volume for each day.

(8) For the purposes of subsection (7), a salt evaporator plant effluent plant volume for a day is the sum of the daily salt evaporator plant effluent volumes determined under section 24 for the day.

(9) Each discharger shall calculate, in cubic metres, a monthly average salt evaporator plant effluent plant volume for each month, by taking the arithmetic mean of the daily salt evaporator plant effluent plant volumes calculated under subsection (7) for the month.

(10) Each discharger shall calculate, in cubic metres, a total emergency overflow effluent plant volume for each day on which an emergency overflow effluent is discharged from the plant.

(11) For the purposes of subsection (10), emergency overflow

effluent plant volume for a day is the sum of the daily emergency overflow effluent volumes determined under section 24 for the day.

## PART VII - STORM WATER CONTROL STUDY

### Storm Water Control Study

26.-(1) Each discharger shall complete a storm water control study in respect of the discharger's plant, in accordance with the requirements of the Ministry of Environment and Energy publication entitled "Protocol for Conducting a Storm Water Control Study", dated August, 1993.

(2) A discharger need not comply with subsection (1) in respect of the discharger's plant if,

- (a) the plant meets the exemption criteria set out in the Ministry of Environment and Energy publication entitled "Protocol for Conducting a Storm Water Control Study," dated August, 1993; and
- (b) the discharger notifies the Director in writing, by ..... .., 199.., that the plant meets the exemption criteria referred to in clause (a).

(The date that is one year after the day on which this Regulation is filed will be inserted in clause 26(2)(b).)

(3) Subject to subsection (4), a discharger shall complete the storm water control study in respect of the discharger's plant by ..... .., 199..

(The date that is two years after the day on which this Regulation is filed will be inserted in subsection 26(3).)

(4) A discharger may postpone completion of the storm water control study in respect of the discharger's plant until January 1, 199.. if,

- (a) in order to meet the requirements of Part IV, the discharger plans to make process changes, install waste water treatment facilities, implement management practices, or make any other changes at the plant that would likely alter the quantity or quality of storm water discharged from the plant; and
- (b) the discharger notifies the Director in writing, by ..... .., 199.., of the plans referred to in clause (a).

(The date that is two years after the day on which this Regulation is filed will be inserted in subsection 26(4)(b).)

(5) Each discharger shall ensure that a copy of each study completed under this section is available to Ministry staff at the discharger's plant, on request during the plant's normal office hours.

## PART VIII - RECORDS AND REPORTS

### Record Keeping

27.-(1) Each discharger shall keep records, in an electronic format acceptable to the Director, of all analytical results obtained under sections 17, 19 and 23, all calculations performed under sections 12 and 13 and all determinations and calculations made or performed under sections 24 and 25.

(2) Each discharger shall keep records of all sampling and analytical procedures used in meeting the requirements of section 7, including, for each sample, the date, the time of pick-up, the sampling procedures used, and any incidents likely to affect the analytical results.

(3) Each discharger shall keep records of the results of all monitoring performed under sections 18 and 20 to 22.

(4) Each discharger shall keep records of all maintenance and calibration procedures performed under section 24.

(5) Each discharger shall keep records of all problems or malfunctions, including those related to sampling, analysis, acute lethality testing, chronic toxicity testing or flow measurement, that result or are likely to result in a failure to comply with a requirement of this Regulation, stating the date, duration and cause of each malfunction, and including a description of any remedial action taken.

(6) Each discharger shall keep records of any incident in which process effluent is discharged from the discharger's plant without flowing past a sampling point established on a process effluent stream in accordance with this Regulation before being discharged, stating the date, duration, cause and nature of each incident.

(7) Each discharger shall keep records of all process changes and redirections of or changes in the character of effluent streams that affect the quality of effluent at any sampling point established under this Regulation at the discharger's plant.

(8) Each discharger shall keep records of the location of each sampling point established at the discharger's plant under Part II.

(9) Each discharger shall make each record required by this section as soon as reasonably possible and shall keep each such record for a period of three years.

(10) Each discharger shall ensure that all records kept under this section are available to Ministry staff at the discharger's plant, on request during the plant's normal office hours.

#### Reports Available to the Public

28.-(1) On or before June 1 in each year, each discharger shall prepare a report relating to the previous calendar year and including,

- (a) a summary of plant loadings calculated under sections 12 and 13;
- (b) a summary of the results of monitoring performed under sections 17 and 19 to 23;
- (c) a summary of calculations performed under subsections 25(1), (4), (7) and (10) ;
- (d) a summary of the loadings, concentrations or other results that exceeded a limit prescribed by section 14 or 15; and
- (e) a summary of the incidents in which process effluent was discharged from the discharger's plant without flowing past a sampling point established on a process effluent stream in accordance with this Regulation before being discharged.

(2) Each discharger shall ensure that each report prepared under subsection (1) is available to any person at the discharger's plant, on request during the plant's normal office hours.

(3) Each discharger shall provide the Director, upon request, with a copy of any report that the discharger has prepared under subsection (1).

#### Reports to the Director - General

29.-(1) Each discharger shall notify the Director in writing of any change of name or ownership of the discharger's plant occurring after ..... , 199., within thirty days after

the end of the month in which the change occurs.

(The date that is the day on which this Regulation is filed will be inserted in subsection 29(1))

(2) Each discharger shall notify the Director in writing of any process change or redirection of or change in the character of an effluent stream that affects the quality of effluent at any sampling point established under this Regulation at the discharger's plant, within thirty days of the change or redirection.

(3) A discharger need not comply with subsection (2) where the effect of the change or redirection on effluent quality is of less than one week's duration.

#### Reports to the Director on Compliance with Section 6 and Part IV

30-(1) Each discharger shall report any incident in which process effluent is discharged from the discharger's plant without flowing past a sampling point established on a process effluent stream in accordance with this Regulation before being discharged.

(2) Each discharger shall report any loading, concentration or other result that exceeds a limit prescribed by section 14 or 15.

(3) A report required under subsection (1) or (2) shall be given orally, as soon as reasonably possible, and in writing, as soon as reasonably possible.

#### Quarterly Reports to the Director

31.-(1) No later than forty-five days after the end of each quarter, each discharger shall submit a report to the Director containing information relating to the discharger's plant throughout the quarter as required by subsections (3) to (10).

(2) A report under this section shall be submitted both in an electronic format acceptable to the Director and in hard copy generated from the electronic format and signed by the discharger.

(3) A report under this section shall include all information included in a report given under section 30 during the quarter.

(4) Each discharger shall report, for each month in the quarter, the monthly average plant loadings, the highest and

lowest daily plant loadings and the monthly average concentration calculated under sections 12 and 13 and the highest and lowest daily concentration for the month for each limited parameter and each assessment parameter.

(5) Each discharger shall report, for each month in the quarter, the monthly average process effluent plant volume and the highest and lowest daily process effluent plant volumes calculated under section 25.

(6) Each discharger shall report, for each month in the quarter, the monthly average cooling water effluent plant volume and the highest and lowest daily cooling water effluent plant volumes calculated under section 25.

(7) Each discharger shall report, for each month in the quarter, the monthly average salt evaporator plant effluent plant volume and the highest and lowest daily salt evaporator plant effluent plant volumes calculated under section 25.

(8) Each discharger shall report, for each month in the quarter, the total emergency overflow effluent plant volume calculated under section 25.

(9) Each discharger shall report the number of days in each month in the quarter on which process effluent was discharged from the discharger's plant.

(10) Each discharger shall report, for each month in the quarter, the highest and lowest pH results obtained under section 19 for each process effluent monitoring stream at the discharger's plant.

#### Reports to the Director on Chronic Toxicity Testing

32.-(1) Each discharger shall report to the Director the results of all monitoring performed under section 22, together with the date on which each sample was picked up, no later than sixty days after the end of each semi-annual period in which the monitoring was performed.

(2) A report under subsection (1) shall include a plot of percentage reduction in growth or reproduction against the logarithm of test concentration and shall include a calculation of the concentration at which a 25 per cent reduction in growth or reproduction would occur.

## PART IX - COMMENCEMENT AND REVOCATION PROVISIONS

## Revocation of O.Reg. 91/90

33. Ontario Regulation 91/90 is revoked on ..... .., 199..

(The date that is 90 days after the day on which this Regulation is filed will be inserted in section 33.)

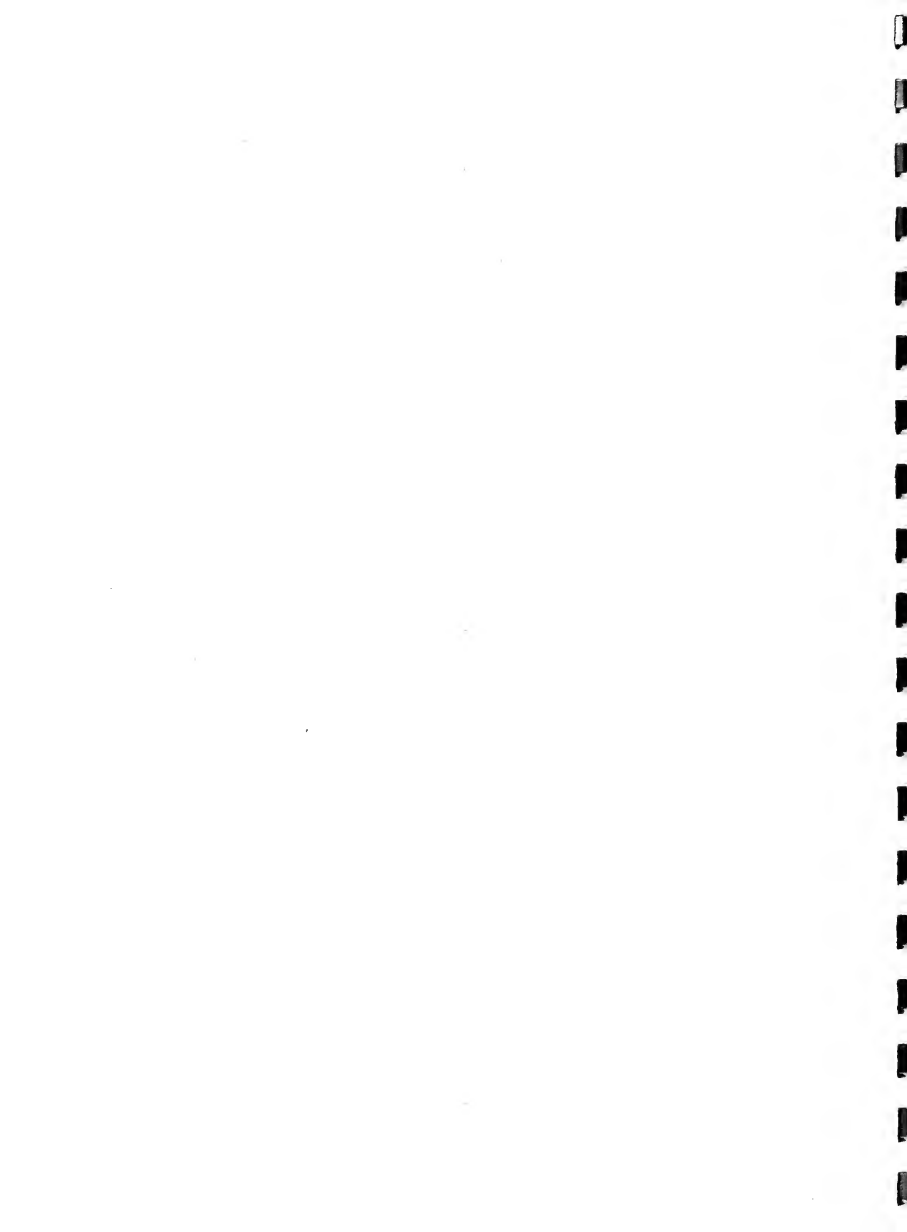
## Commencement of Parts IV, V and VI

34.-(1) Part IV comes into force on ..... .., 199..

(The date that is three years after the day on which this Regulation is filed will be inserted in subsection 34(1).)

(2) Parts V and VI come into force on ..... .., 199..

(The date that is 90 days after the day on which this Regulation is filed will be inserted in subsection 34(2).)



## Schedule 1:

## List of Regulated Plants

**PLANT:**

All Existing and New Operating Industrial Mineral Mines

All Existing and Operating Industrial Mineral Manufacturing Facilities

## Schedule 2:

## Process Effluent Limits and Monitoring Frequency

**PLANT:**

All Existing and New Operating Industrial Mineral Mines

All Existing and Operating Industrial Mineral Manufacturing Facilities

ATG	Parameter	Monitoring Frequency	Daily Concentration Limit	Monthly Average Concentration Limit
			mg/L	mg/L
	Column 1	Column 2	Column 3	Column 4
8	Total Suspended Solids (TSS)	W	50	25
	Total Suspended Solids (TSS)	W		15*

## Explanatory notes:

W = Weekly

ATG = Analytical Test Group

mg/L = milligrams per litre

\* = Site Specific Requirement for Applied Carbon Technology, Inc., Kearney, Unimin Canada Ltd., Blue Mountain and Unimin Canada Ltd., Nephthor

**Schedule 3:****Cooling Water Effluent and Salt Evaporator Plant Effluent  
Assessment Monitoring Requirements**

<b>PLANT:</b> <b>All Existing and New Operating Industrial Mineral Mines</b> <b>All Existing and Operating Industrial Mineral Manufacturing Facilities</b>		
ATG	Parameter	Monitoring Frequency
	Column 1	Column 2
8	Total Suspended Solids (TSS)	W

Explanatory notes:

W = Weekly

ATG = Analytical Test Group

**Schedule 4:****Emergency Overflow Effluent  
Assessment Monitoring Requirements**

<b>PLANT:</b> <b>All Existing and New Operating Industrial Mineral Mines</b> <b>All Existing and Operating Industrial Mineral Manufacturing Facilities</b>		
ATG	Parameter	Monitoring Frequency
	Column 1	Column 2
8	Total Suspended Solids (TSS)	D

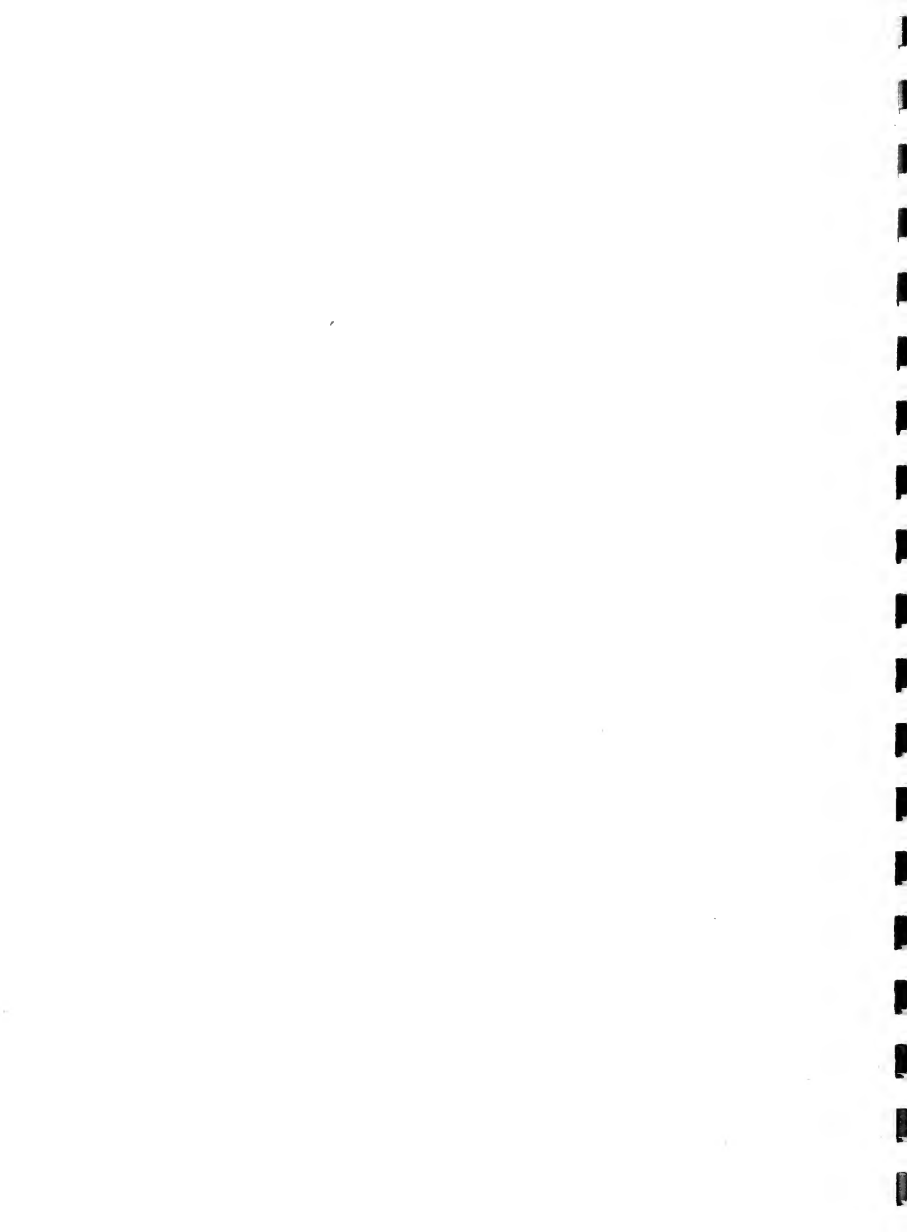
Explanatory notes:

D = Daily monitoring requirement

ATG = Analytical Test Group

## APPENDIX II

### THE MONITORING DATA SUMMARY



## Legend to Summary of Monitoring Data

Company Identification:	Indicates the owner of the company and the "company number" that was assigned to each company. The format is: Company Number - Company Owner eg. 1 - St. Lawrence Cement
Effluent Identification:	Indicates the effluent type abbreviation, the sampling point identification number and the effluent description. The format is: Effluent type abbreviation Sampling point identification - Effluent identification. eg. CP 0100 - Cement Plant Effluent Effluent type abbreviations are: CP Cement Plant Effluent DC Dust Collector Effluent GP Graphite Plant Effluent GYP Gypsum Plant Effluent IN Intake Water LP Lime Plant Effluent MP Magnesium Plant Effluent MW Mine Water Effluent PW Process Water Effluent QW Quarry Water Effluent SW Storm Water Effluent WW Wash Water Effluent
ATG:	Parameters are grouped in analytical test groups (ATG's) according to their analytical similarity. eg. ATG 9 contains all metals.
RMDL:	The regulation method detection limit is the maximum analytical detection limit allowable as stipulated by the effluent monitoring regulation. All analytical procedures were required to meet the RMDL specified for each parameter.
Samples >RMDL:	The number of samples for a parameter that were detected at a level greater-than-or-equal-to the RMDL.
Number of Samples:	The total number samples reported for each parameter for an effluent.
Average Concentration:	The arithmetic mean concentration.
Average Loading:	The arithmetic mean of the daily loadings.
Annual Loading:	The average daily loading from an effluent multiplied by the number of days effluent was discharged over the monitoring year.



# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>1 – St. Lawrence Cement</b>							
<b>CP 0100 – Cement Plant Effluent</b>							
03	Hydrogen ion (pH)			150	8.26		
07	Specific conductance	5 uS/cm	2	2	1330 uS/cm		
08	Total suspended solids	5 mg/L	121	151	20.9 mg/L	374	136000
09	Aluminum	30 ug/L	2	2	98.5 ug/L	1.65	602
14	Phenolics (4AAP)	2 ug/L	5	12	1.58 ug/L	0.0298	10.5
25	Oil and grease	1 mg/L	44	152	1.15 mg/L	20.3	7400
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.57 mg/L	9.71	3540
5a	DOC	0.5 mg/L	2	2	1.9 mg/L	32.1	11700
30	Chlorides	2 mg/L	12	12	42.5 mg/L	735	268000
30	Sulphates	5 mg/L	12	12	60.3 mg/L	1050	384000
98	Flow			293	17000 m3/day		
	Number of Days of Effluent Discharge			365			
<b>2 – LaFarge, Bath</b>							
<b>CP 0200 – Cement Plant Effluent</b>							
03	Hydrogen ion (pH)			144	8.32		
07	Specific conductance	5 uS/cm	2	2	295 uS/cm		
08	Total suspended solids	5 mg/L	71	144	10.6 mg/L	33.1	12100
09	Aluminum	30 ug/L	2	2	393 ug/L	0.151	55.2
25	Oil and grease	1 mg/L	23	143	1.14 mg/L	4.05	1480
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.29 mg/L	1.3	475
5a	DOC	0.5 mg/L	2	2	3 mg/L	16	5830
30	Chlorides	2 mg/L	12	12	21.5 mg/L	118	43200
30	Sulphates	5 mg/L	12	12	36.7 mg/L	206	75100
98	Flow			273	3200 m3/day		
	Number of Days of Effluent Discharge			365			
<b>2 – LaFarge, Bath</b>							
<b>QW 0300 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			144	8.07		
06	Total phosphorus	0.1 mg/L	2	2	0.155 mg/L	0.0172	6.29
07	Specific conductance	5 uS/cm	2	2	1400 uS/cm		
08	Total suspended solids	5 mg/L	134	143	55.9 mg/L	25.8	9400
09	Aluminum	30 ug/L	2	2	1820 ug/L	0.394	144
14	Phenolics (4AAP)	2 ug/L	7	12	2.18 ug/L	0.00042	0.153
25	Oil and grease	1 mg/L	23	144	1.06 mg/L	0.418	153
4a	Ammonia plus Ammonium	0.25 mg/L	8	12	0.483 mg/L	0.147	53.7
4b	Nitrate + Nitrite	0.25 mg/L	2	2	6.6 mg/L	0.836	305
5a	DOC	0.5 mg/L	2	2	1.1 mg/L	0.16	58.4
30	Chlorides	2 mg/L	2	2	285 mg/L	30.8	11200
30	Sulphates	5 mg/L	2	2	910 mg/L	102	37300
98	Flow			225	469 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector — Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG Parameter

RMDL

Samples  
>RMDL

Number  
of  
Samples

Average  
Concentration

Average  
Loading  
(kg/day)

Annual  
Loading  
(kg/year)

### 2 — LaFarge, Bath

#### SW 0400 — Stormwater Effluent

03	Hydrogen ion (pH)			3	8.13		
07	Specific conductance	5 uS/cm	3	3	1410 uS/cm		
08	Total suspended solids	5 mg/L	3	3	34 mg/L	19.8	N/A
25	Oil and grease	1 mg/L	2	3	1.33 mg/L	0.877	N/A
4b	Nitrate + Nitrite	0.25 mg/L	2	3	0.4 mg/L	0.247	N/A
30	Chlorides	2 mg/L	3	3	183 mg/L	114	N/A
30	Sulphates	5 mg/L	3	3	300 mg/L	141	N/A
98	Flow			3	589 m3/day		
	Number of Days of Effluent Discharge			Not Available			

### 3 — LaFarge, Woodstock

#### CP 0100 — Cement Plant Effluent

03	Hydrogen ion (pH)			142	8.29		
08	Total suspended solids	5 mg/L	133	143	232 mg/L	93.4	34100
09	Aluminum	30 ug/L	2	2	140 ug/L	0.0374	13.6
09	Zinc	10 ug/L	2	2	11.5 ug/L	0.00205	0.748
14	Phenolics (4AAP)	2 ug/L	9	12	3.1 ug/L	0.00311	1.14
15	Sulphide	0.02 mg/L	2	2	0.05 mg/L	0.00691	2.52
25	Oil and grease	1 mg/L	113	143	4.28 mg/L	1.49	544
4b	Nitrate + Nitrite	0.25 mg/L	2	2	1.25 mg/L	0.256	93.5
5a	DOC	0.5 mg/L	2	2	1.9 mg/L	0.276	101
30	Chlorides	2 mg/L	12	12	117 mg/L	83.3	30400
30	Sulphates	5 mg/L	12	12	639 mg/L	362	132000
98	Flow			113	619 m3/day		
	Number of Days of Effluent Discharge			365			

### 3 — LaFarge, Woodstock

#### QW 0200 — Quarrywater Effluent

03	Hydrogen ion (pH)			112	8.28		
08	Total suspended solids	5 mg/L	111	112	103 mg/L	180	32500
09	Aluminum	30 ug/L	2	2	755 ug/L	0.403	72.9
14	Phenolics (4AAP)	2 ug/L	6	10	2.52 ug/L	0.00479	0.867
15	Sulphide	0.02 mg/L	2	2	0.04 mg/L	0.00575	1.04
25	Oil and grease	1 mg/L	35	112	1.43 mg/L	2.4	435
4a	Ammonia plus Ammonium	0.25 mg/L	7	11	0.375 mg/L	0.545	98.6
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.96 mg/L	0.432	78.1
5a	DOC	0.5 mg/L	2	2	1.65 mg/L	0.432	78.1
30	Chlorides	2 mg/L	2	2	97 mg/L	28.2	5100
30	Sulphates	5 mg/L	2	2	495 mg/L	132	24000
98	Flow			241	1620 m3/day		
	Number of Days of Effluent Discharge			181			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>4 – Essroc Canada Inc.</b>							
<b>CP 0300 – Cement Plant Effluent</b>							
03	Hydrogen ion (pH)			149	8.41		
07	Specific conductance	5 uS/cm	2	2	290 uS/cm		
08	Total suspended solids	5 mg/L	129	149	31.7 mg/L	228	83100
09	Aluminum	30 ug/L	2	2	190 ug/L	1.27	463
14	Phenolics (4AAP)	2 ug/L	10	12	2.5 ug/L	0.0175	6.38
25	Oil and grease	1 mg/L	44	149	1.45 mg/L	10.3	3750
5a	DOC	0.5 mg/L	2	2	4.05 mg/L	26.8	9780
30	Chlorides	2 mg/L	12	12	14.8 mg/L	103	37400
30	Sulphates	5 mg/L	12	12	20.6 mg/L	143	52000
98	Flow			156	7100 m3/day		
	Number of Days of Effluent Discharge			365			
<b>4 – Essroc Canada Inc.</b>							
<b>QW 0400 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			119	8.88		
07	Specific conductance	5 uS/cm	2	2	1500 uS/cm		
08	Total suspended solids	5 mg/L	86	119	31.5 mg/L	73.8	26900
09	Aluminum	30 ug/L	2	2	145 ug/L	0.521	190
14	Phenolics (4AAP)	2 ug/L	9	12	5.45 ug/L	0.0159	5.8
25	Oil and grease	1 mg/L	27	121	1.28 mg/L	3.47	1270
4a	Ammonia plus Ammonium	0.25 mg/L	9	12	0.586 mg/L	1.6	585
4b	Nitrate + Nitrite	0.25 mg/L	2	2	6.15 mg/L	20.2	7390
5a	DOC	0.5 mg/L	2	2	3.45 mg/L	14	5100
30	Chlorides	2 mg/L	2	2	225 mg/L	790	289000
30	Sulphates	5 mg/L	2	2	300 mg/L	992	362000
98	Flow			203	2990 m3/day		
	Number of Days of Effluent Discharge			365			
<b>5 – St. Marys, Bowmanville</b>							
<b>CP 0100 – Cement Plant Effluent</b>							
03	Hydrogen ion (pH)			145	8.25		
07	Specific conductance	5 uS/cm	2	2	370 uS/cm		
08	Total suspended solids	5 mg/L	143	145	115 mg/L	487	178000
09	Aluminum	30 ug/L	2	2	290 ug/L	0.99	361
14	Phenolics (4AAP)	2 ug/L	6	12	3.03 ug/L	0.0095	3.47
25	Oil and grease	1 mg/L	53	145	1.33 mg/L	5	1830
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.505 mg/L	1.76	641
5a	DOC	0.5 mg/L	2	2	2.1 mg/L	7.75	2830
30	Chlorides	2 mg/L	12	12	37.8 mg/L	96.3	35100
30	Sulphates	5 mg/L	12	12	41.7 mg/L	112	40900
98	Flow			289	3420 m3/day		
	Number of Days of Effluent Discharge			365			

**MISA Industrial Minerals Sector — Average Concentrations and Loadings for Found Parameters**

**Regulated Plants**

**Company Identification  
Effluent Identification**

ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>5 — St. Marys, Bowmanville</b>							
<b>QW 0200 — Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			120	7.79		
07	Specific conductance	5 uS/cm	2	2	12300 uS/cm		
08	Total suspended solids	5 mg/L	121	121	202 mg/L		61700
09	Aluminum	30 ug/L	2	2	1450 ug/L	1.54	489
14	Phenolics (4AAP)	2 ug/L	10	11	39.1 ug/L	0.0319	9.71
15	Sulphide	0.02 mg/L	2	2	0.075 mg/L	0.0919	27.9
25	Oil and grease	1 mg/L	94	119	3.2 mg/L	2.84	862
4a	Ammonia plus Ammonium	0.25 mg/L	12	12	4.19 mg/L	3.46	1050
4b	Nitrate + Nitrite	0.25 mg/L	2	2	2.15 mg/L	2.43	739
5a	DOC	0.5 mg/L	2	2	2.85 mg/L	3.11	944
30	Chlorides	2 mg/L	2	2	3950 mg/L	3640	1110000
30	Sulphates	5 mg/L	2	2	170 mg/L	206	62600
98	Flow			236	926 m3/day		
	Number of Days of Effluent Discharge			304			
<b>6 — St. Marys, St Marys</b>							
<b>CP 0100 — Cement Plant Effluent</b>							
03	Hydrogen ion (pH)			152	6.35		
07	Specific conductance	5 uS/cm	2	2	1050 uS/cm		
08	Total suspended solids	5 mg/L	92	153	18.4 mg/L	38.6	32300
09	Aluminum	30 ug/L	2	2	385 ug/L	1.13	413
09	Zinc	10 ug/L	2	2	36.5 ug/L	0.11	40.3
14	Phenolics (4AAP)	2 ug/L	6	12	2.52 ug/L	0.00639	2.33
15	Sulphide	0.02 mg/L	2	2	0.025 mg/L	0.0964	35.2
25	Oil and grease	1 mg/L	43	152	1.24 mg/L	5.72	2090
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.905 mg/L	2.72	992
5a	DOC	0.5 mg/L	2	2	1.85 mg/L	6.68	2440
30	Chlorides	2 mg/L	12	12	76.8 mg/L	369	135000
30	Sulphates	5 mg/L	12	12	222 mg/L	910	332000
98	Flow			280	4830 m3/day		
	Number of Days of Effluent Discharge			365			
<b>6 — St. Marys, St Marys</b>							
<b>QW 0200 — Quarrywater Effluent N</b>							
03	Hydrogen ion (pH)			141	6.17		
07	Specific conductance	5 uS/cm	2	2	715 uS/cm		
08	Total suspended solids	5 mg/L	108	139	45.1 mg/L	382	139000
09	Zinc	10 ug/L	2	2	24 ug/L	0.191	69.8
14	Phenolics (4AAP)	2 ug/L	7	12	3 ug/L	0.0204	7.43
15	Sulphide	0.02 mg/L	2	2	0.045 mg/L	0.352	128
25	Oil and grease	1 mg/L	47	139	1.57 mg/L	12.6	4670
4a	Ammonia plus Ammonium	0.25 mg/L	5	12	0.231 mg/L	1.92	700
4b	Nitrate + Nitrite	0.25 mg/L	2	2	0.956 mg/L	7.6	2850
5a	DOC	0.5 mg/L	2	2	2.15 mg/L	17.4	6360
30	Chlorides	2 mg/L	2	2	32.5 mg/L	259	94400
30	Sulphates	5 mg/L	2	2	135 mg/L	1080	393000
98	Flow			220	8480 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

Company Identification							
Effluent Identification							
ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>6 – St. Marys, St Marys</b>							
<b>SW 0400 – Stormwater Effluent</b>							
03	Hydrogen ion (pH)			6	8.32		
07	Specific conductance	5 uS/cm	7	7	410 uS/cm		
08	Total suspended solids	5 mg/L	4	6	117 mg/L	38.2	N/A
4b	Nitrate + Nitrite	0.25 mg/L	7	7	4.23 mg/L	1.02	N/A
30	Chlorides	2 mg/L	7	7	12.7 mg/L	2.48	N/A
30	Sulphates	5 mg/L	7	7	20 mg/L	3.74	N/A
98	Flow			7	184 m3/day		
	Number of Days of Effluent Discharge			Not Available			
<b>6 – St. Marys, St Marys</b>							
<b>SW 0500 – Stormwater Effluent CP</b>							
03	Hydrogen ion (pH)			10	10.5		
07	Specific conductance	5 uS/cm	11	11	2050 uS/cm		
08	Total suspended solids	5 mg/L	10	10	215 mg/L	85.5	N/A
14	Phenolics (4AAP)	2 ug/L	6	11	3.94 ug/L	0.00172	N/A
4b	Nitrate + Nitrite	0.25 mg/L	10	11	1.14 mg/L	0.383	N/A
30	Chlorides	2 mg/L	10	11	209 mg/L	89.9	N/A
30	Sulphates	5 mg/L	11	11	179 mg/L	63.5	N/A
98	Flow			11	343 m3/day		
	Number of Days of Effluent Discharge			Not Available			
<b>7 – Stelco Inc.</b>							
<b>LP 0100 – Lime Plant Effluent</b>							
03	Hydrogen ion (pH)			109	8.06		
07	Specific conductance	5 uS/cm	2	2	716 uS/cm		
08	Total suspended solids	5 mg/L	66	109	7.02 mg/L	150	54600
09	Aluminum	30 ug/L	2	2	240 ug/L	6.25	2280
09	Nickel	20 ug/L	2	2	59 ug/L	1.55	565
09	Vanadium	30 ug/L	2	2	251 ug/L	6.53	2380
25	Oil and grease	1 mg/L	20	109	1.06 mg/L	22.1	8080
4a	Ammonia plus Ammonium	0.25 mg/L	11	12	0.327 mg/L	7.35	2680
5a	DOC	0.5 mg/L	2	2	1.15 mg/L	30.4	11100
30	Chlorides	2 mg/L	2	2	99 mg/L	2610	954000
30	Sulphates	5 mg/L	2	2	248 mg/L	6520	2380000
98	Flow			109	21000 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
8 – Beachville Ltd., East							
LP 0100 – Lime Plant Effluent E							
02	Cyanide Total	0.005 mg/L	2	2	0.015 mg/L	0.262	95.7
03	Hydrogen ion (pH)			157	8.72		
07	Specific conductance	5 uS/cm	2	2	1450 uS/cm		
08	Total suspended solids	5 mg/L	132	157	23.8 mg/L		205000
09	Aluminum	30 ug/L	2	2	155 ug/L	2.73	996
14	Phenolics (4AAP)	2 ug/L	2	2	13 ug/L	0.242	88.2
25	Oil and grease	1 mg/L	55	157	1.17 mg/L	26.3	9590
4a	Ammonia plus Ammonium	0.25 mg/L	9	12	0.333 mg/L	6.68	2440
4b	Nitrate+Nitrite	0.25 mg/L	2	2	3.55 mg/L	63.6	23200
5a	DOC	0.5 mg/L	2	2	2.7 mg/L	47.2	17200
30	Chlorides	2 mg/L	2	2	67 mg/L	1160	425000
30	Sulphates	5 mg/L	2	2	675 mg/L	12300	4490000
98	Flow			157	21100 m3/day		
	Number of Days of Effluent Discharge			365			
9 – Guelph Dolime							
LP 0100 – Lime Plant Effluent N							
03	Hydrogen ion (pH)			156	7.67		
07	Specific conductance	5 uS/cm	2	2	1550 uS/cm		
08	Total suspended solids	5 mg/L	51	155	8.38 mg/L	12.4	4540
09	Zinc	10 ug/L	2	2	68.5 ug/L	0.102	37.1
25	Oil and grease	1 mg/L	52	154	1 mg/L	1.49	543
4a	Ammonia plus Ammonium	0.25 mg/L	11	13	0.291 mg/L	0.431	157
4b	Nitrate+Nitrite	0.25 mg/L	2	2	1.75 mg/L	2.8	947
5a	DOC	0.5 mg/L	2	2	2.35 mg/L	3.49	1270
30	Chlorides	2 mg/L	2	2	275 mg/L	408	149000
30	Sulphates	5 mg/L	2	2	135 mg/L	200	73100
98	Flow			157	1480 m3/day		
	Number of Days of Effluent Discharge			365			
9 – Guelph Dolime							
LP 0200 – Lime Plant Effluent S							
03	Hydrogen ion (pH)			155	7.97		
07	Specific conductance	5 uS/cm	2	2	1300 uS/cm		
08	Total suspended solids	5 mg/L	122	154	23.4 mg/L	146	53500
09	Aluminum	30 ug/L	2	2	97 ug/L	0.606	221
09	Zinc	10 ug/L	2	2	64.5 ug/L	0.403	147
25	Oil and grease	1 mg/L	55	157	1.1 mg/L	6.86	2500
4a	Ammonia plus Ammonium	0.25 mg/L	11	13	0.368 mg/L	2.3	841
4b	Nitrate+Nitrite	0.25 mg/L	2	2	1.35 mg/L	6.41	3070
5a	DOC	0.5 mg/L	2	2	2.15 mg/L	13.4	4910
30	Chlorides	2 mg/L	2	2	160 mg/L	1000	365000
30	Sulphates	5 mg/L	2	2	190 mg/L	1190	434000
98	Flow			157	6250 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

Company Identification		RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter						
10 - Reiss Lime Company Ltd.							
LP 0100 - Lime Plant Effluent							
02	Cyanide Total	0.005 mg/L	2	2	0.02 mg/L	0.0111	3.4
03	Hydrogen ion (pH)			127	10.4		
07	Specific conductance	5 uS/cm	2	2	899 uS/cm		
08	Total suspended solids	5 mg/L	113	127	19.1 mg/L	8.76	2700
09	Aluminum	30 ug/L	2	2	815 ug/L	0.45	139
09	Copper	10 ug/L	4	12	7.92 ug/L	0.00431	1.33
09	Vanadium	30 ug/L	2	2	331 ug/L	0.183	56.2
14	Phenolics (4AAP)	2 ug/L	7	12	339 ug/L	0.124	38.1
15	Sulphide	0.02 mg/L	2	2	5.06 mg/L	2.79	860
19	Phenanthrene	0.4 ug/L	2	2	1.45 ug/L	0.0008	0.246
20	2,4 - Dimethylphenol	7.3 ug/L	9	12	55.1 ug/L	0.0328	10.1
20	Phenol	2.4 ug/L	12	12	218 ug/L	0.121	37.3
20	m - Cresol	3.4 ug/L	12	12	84.1 ug/L	0.044	13.5
20	o - Cresol	3.7 ug/L	12	12	106 ug/L	0.0588	18.1
20	p - Cresol	3.5 ug/L	11	12	94.4 ug/L	0.0558	17.2
25	Oil and grease	1 mg/L	101	122	3.28 mg/L	1.62	498
4b	Nitrate + Nitrite	0.25 mg/L	2	2	1.68 mg/L	0.928	286
5a	DOC	0.5 mg/L	2	2	6.35 mg/L	3.51	1080
98	Flow			77	552 m3/day		
	Number of Days of Effluent Discharge			308			
11 - Steetley Quarry Products							
LP 0100 - Lime Plant Effluent							
03	Hydrogen ion (pH)			143	7.13		
07	Specific conductance	5 uS/cm	2	2	1480 uS/cm		
08	Total suspended solids	5 mg/L	108	143	11.2 mg/L	103	32600
25	Oil and grease	1 mg/L	58	143	1.44 mg/L	12.8	3990
4a	Ammonia plus Ammonium	0.25 mg/L	5	16	0.597 mg/L	5.15	1630
4b	Nitrate + Nitrite	0.25 mg/L	2	2	1.53 mg/L	12	3800
30	Chlorides	2 mg/L	2	2	163 mg/L	1390	441000
30	Sulphates	5 mg/L	2	2	351 mg/L	3110	985000
98	Flow			140	8820 m3/day		
	Number of Days of Effluent Discharge			317			
12 - Beachville Ltd., West							
LP 0100 - Lime Plant Effluent W							
03	Hydrogen ion (pH)			156	7.97		
07	Specific conductance	5 uS/cm	2	2	915 uS/cm		
08	Total suspended solids	5 mg/L	112	156	54.5 mg/L	767	280000
09	Aluminum	30 ug/L	2	2	100 ug/L	1.35	492
25	Oil and grease	1 mg/L	46	142	1.19 mg/L	17.2	6270
4a	Ammonia plus Ammonium	0.25 mg/L	6	11	0.282 mg/L	3.84	1400
4b	Nitrate + Nitrite	0.25 mg/L	2	2	2.4 mg/L	32.1	11700
5a	DOC	0.5 mg/L	2	2	6.45 mg/L	83.4	30500
30	Chlorides	2 mg/L	2	2	78.5 mg/L	1030	376000
30	Sulphates	5 mg/L	2	2	190 mg/L	2500	911000
98	Flow			156	13900 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector — Average Concentrations and Loadings for Found Parameters

## Regulated Plants

Company Identification Effluent Identification		RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter						
13 - Timminco Ltd.							
MP 0100 - Magnesium Plant Effluent							
03	Hydrogen ion (pH)			158	7.89		
07	Specific conductance	5 uS/cm	2	2	894 uS/cm		
09	Cobalt	20 ug/L	2	2	25 ug/L	0.0859	31.4
09	Nickel	20 ug/L	2	2	70 ug/L	0.258	94.8
09	Zinc	10 ug/L	2	2	15 ug/L	0.0623	22.7
4a	Ammonia plus Ammonium	0.25 mg/L	10	13	10.8 mg/L	34.3	12500
5a	DOC	0.5 mg/L	2	2	9.74 mg/L	40.5	14800
98	Flow			130	2490 m3/day		
	Number of Days of Effluent Discharge			365			
13 - Timminco Ltd.							
SW 0200 - Stormwater Effluent							
02	Cyanide Total	0.005 mg/L	7	12	0.0129 mg/L	0.00091	0.332
03	Hydrogen ion (pH)			12	8.07		
08	Total suspended solids	5 mg/L	6	12	10.4 mg/L	3.45	1260
4a	Ammonia plus Ammonium	0.25 mg/L	12	12	1.57 mg/L	0.136	49.8
98	Flow			8	122 m3/day		
	Number of Days of Effluent Discharge			365			
14 - Cal Graphite Corp.							
GP 0100 - Graphite Plant Effluent							
03	Hydrogen ion (pH)			139	6.43		
07	Specific conductance	5 uS/cm	2	2	187 uS/cm		
08	Total suspended solids	5 mg/L	68	138	11.3 mg/L	144	52400
09	Copper	10 ug/L	4	13	9.31 ug/L	0.11	40.2
09	Zinc	10 ug/L	12	13	59.2 ug/L	0.707	258
14	Phenolics (4AAP)	2 ug/L	12	13	18.9 ug/L	0.228	83.4
25	Oil and grease	1 mg/L	81	135	1.51 mg/L	16	5860
30	Sulphates	5 mg/L	2	2	50.9 mg/L	417	152000
98	Flow			139	10500 m3/day		
	Number of Days of Effluent Discharge			365			
15 - Westroc Industries Ltd.							
MW 0100 - Minewater Effluent							
03	Hydrogen ion (pH)			156	7.87		
07	Specific conductance	5 uS/cm	2	2	9410 uS/cm		
08	Total suspended solids	5 mg/L	97	156	10.5 mg/L	13.9	5090
09	Zinc	10 ug/L	2	2	15 ug/L	0.0227	8.29
14	Phenolics (4AAP)	2 ug/L	12	12	35.8 ug/L	0.0558	20.4
15	Sulphide	0.02 mg/L	2	2	8.38 mg/L	22.8	8260
19	Di-n-butyl phthalate	3.8 ug/L	2	2	11.4 ug/L	0.0187	8.84
25	Oil and grease	1 mg/L	151	156	12.8 mg/L	18.9	8170
4a	Ammonia plus Ammonium	0.25 mg/L	12	12	4.01 mg/L	5.98	2180
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	4.94 mg/L	13.1	4770
30	Chlorides	2 mg/L	2	2	2550 mg/L	4500	1640000
30	Sulphates	5 mg/L	2	2	1060 mg/L	3090	1130000
98	Flow			156	1200 m3/day		
	Number of Days of Effluent Discharge			365			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>16 – CGC Inc.</b>							
<b>GYP 0200 – Gypsum Plant Effluent</b>							
03	Hydrogen ion (pH)			157	7.89		
07	Specific conductance	5 uS/cm	2	2	2500 uS/cm		
08	Total suspended solids	5 mg/L	152	157	39.5 mg/L		86000
09	Aluminum	30 ug/L	2	2	135 ug/L	0.402	147
25	Oil and grease	1 mg/L	24	155	1.18 mg/L	5.79	2110
4a	Ammonia plus Ammonium	0.25 mg/L	2	2	0.61 mg/L	1.67	609
4b	Nitrate + Nitrite	0.25 mg/L	2	2	2.6 mg/L	7.48	2730
5a	DOC	0.5 mg/L	2	2	1.25 mg/L	3.88	1420
30	Chlorides	2 mg/L	2	2	36 mg/L	106	38600
30	Sulphates	5 mg/L	2	2	1350 mg/L	3860	1410000
98	Flow			154	5500 m3/day		
	Number of Days of Effluent Discharge			365			
<b>16 – CGC Inc.</b>							
<b>MW 0100 – Minewater</b>							
03	Hydrogen ion (pH)			157	7.91		
07	Specific conductance	5 uS/cm	2	2	2350 uS/cm		
08	Total suspended solids	5 mg/L	130	157	17.8 mg/L	102	37300
09	Aluminum	30 ug/L	2	2	844 ug/L	3.54	1290
09	Zinc	10 ug/L	2	2	12 ug/L	0.0449	16.4
25	Oil and grease	1 mg/L	22	156	1.07 mg/L	4.37	1600
4a	Ammonia plus Ammonium	0.25 mg/L	7	12	0.324 mg/L	1.31	479
4b	Nitrate + Nitrite	0.25 mg/L	2	2	2.6 mg/L	10.2	3730
5a	DOC	0.5 mg/L	2	2	2.65 mg/L	8.89	3170
30	Chlorides	2 mg/L	2	2	31.5 mg/L	116	42200
30	Sulphates	5 mg/L	2	2	1250 mg/L	4580	1670000
98	Flow			154	4010 m3/day		
	Number of Days of Effluent Discharge			365			
<b>17 – Domtar Inc.</b>							
<b>GYP 0200 – Gypsum Plant Effluent</b>							
03	Hydrogen ion (pH)			157	7.96		
06	Total phosphorus	0.1 mg/L	2	2	0.12 mg/L	1.05	385
07	Specific conductance	5 uS/cm	2	2	2050 uS/cm		
08	Total suspended solids	5 mg/L	145	157	29 mg/L	139	50800
09	Aluminum	30 ug/L	2	2	670 ug/L	6.52	2380
15	Sulphide	0.02 mg/L	2	2	0.135 mg/L	1.06	388
5a	DOC	0.5 mg/L	2	2	5.2 mg/L	47.8	17400
30	Chlorides	2 mg/L	2	2	51.5 mg/L	466	170000
30	Sulphates	5 mg/L	2	2	975 mg/L	8370	3060000
98	Flow			152	4330 m3/day		
	Number of Days of Effluent Discharge			365			

MISA Industrial Minerals Sector - Average Concentrations and Loadings for Found Parameters

Regulated Plants

Company Identification  
Effluent Identification

ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
17 - Domtar Inc.							
MW 0100 - Minewater Effluent							
03	Hydrogen ion (pH)			109	7.78		
07	Specific conductance	5 uS/cm	2	2	3100 uS/cm		
08	Total suspended solids	5 mg/L	92	109	42.7 mg/L	2.84	1040
14	Phenolics (4AAP)	2 ug/L	6	12	1.67 ug/L	0.00034	0.124
15	Sulphide	0.02 mg/L	2	2	0.075 mg/L	0.018	6.57
25	Oil and grease	1 mg/L	56	107	2.24 mg/L	0.232	84.6
4a	Ammonia plus Ammonium	0.25 mg/L	10	12	3.61 mg/L	0.262	95.7
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	9.6 mg/L	1.88	688
5a	DOC	0.5 mg/L	2	2	1.55 mg/L	0.345	126
30	Chlorides	2 mg/L	2	2	155 mg/L	31.5	11500
30	Sulphates	5 mg/L	2	2	1550 mg/L	337	123000
98	Flow			40	199 m3/day		
	Number of Days of Effluent Discharge			365			
17 - Domtar Inc.							
MW 0300 - Minewater Effluent							
03	Hydrogen ion (pH)			156	7.94		
07	Specific conductance	5 uS/cm	2	2	1600 uS/cm		
08	Total suspended solids	5 mg/L	140	156	31.3 mg/L	94.2	34400
09	Aluminum	30 ug/L	2	2	560 ug/L	0.802	293
15	Sulphide	0.02 mg/L	2	2	0.055 mg/L	0.0961	35.8
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	2.47 mg/L	2.74	1000
5a	DOC	0.5 mg/L	2	2	7.5 mg/L	11.4	4170
30	Chlorides	2 mg/L	2	2	63.5 mg/L	107	39000
30	Sulphates	5 mg/L	2	2	665 mg/L	1040	378000
98	Flow			150	1190 m3/day		
	Number of Days of Effluent Discharge			365			
17 - Domtar Inc.							
MW 0400 - Minewater Effluent							
03	Hydrogen ion (pH)			29	7.84		
08	Total suspended solids	5 mg/L	28	29	118 mg/L	60.4	6640
14	Phenolics (4AAP)	2 ug/L	2	2	24 ug/L	0.0248	2.73
25	Oil and grease	1 mg/L	27	29	3.82 mg/L	2.42	288
98	Flow			10	1040 m3/day		
	Number of Days of Effluent Discharge			110			
18 - Unimin Canada Ltd.							
PW 0100 - Process Effluent							
03	Hydrogen ion (pH)			83	8.61		
08	Total suspended solids	5 mg/L	42	82	47.1 mg/L	53	10300
14	Phenolics (4AAP)	2 ug/L	5	12	4.88 ug/L	0.00277	0.54
98	Flow			83	565 m3/day		
	Number of Days of Effluent Discharge			195			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

Company Identification Effluent Identification		RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter						
19 – Canada Talc Ltd.							
MW 0100 – Minewater Effluent							
03	Hydrogen ion (pH)			146	8.12		
07	Specific conductance	5 uS/cm	2	2	800 uS/cm		
08	Total suspended solids	5 mg/L	49	148	9.41 mg/L	43.1	15700
09	Cadmium	2 ug/L	5	14	3.16 ug/L	0.0155	5.64
09	Nickel	20 ug/L	2	2	45 ug/L	0.366	133
10	Arsenic	5 ug/L	12	14	18 ug/L	0.0658	23.9
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	4.95 mg/L	43.5	15900
5a	DOC	0.5 mg/L	2	2	11.1 mg/L	97.1	35400
98	Flow			147	1420 m3/day		
	Number of Days of Effluent Discharge			365			
20 – Luzenac Inc.							
MW 0100 – Minewater Effluent							
03	Hydrogen ion (pH)			144	8.68		
06	Total phosphorus	0.1 mg/L	2	2	1.56 mg/L	1.58	574
07	Specific conductance	5 uS/cm	2	2	388 uS/cm		
09	Cadmium	2 ug/L	4	12	4.2 ug/L	0.00186	0.877
09	Cobalt	20 ug/L	2	2	20 ug/L	0.0216	7.86
09	Zinc	10 ug/L	2	2	30 ug/L	0.0365	13.3
10	Arsenic	5 ug/L	12	12	82.2 ug/L	0.0603	21.9
5a	DOC	0.5 mg/L	2	2	13.7 mg/L	18.6	6780
98	Flow			145	633 m3/day		
	Number of Days of Effluent Discharge			364			
20 – Luzenac Inc.							
PW 0200 – Process Effluent							
03	Hydrogen ion (pH)			142	8.32		
07	Specific conductance	5 uS/cm	2	2	467 uS/cm		
08	Total suspended solids	5 mg/L	45	143	16.9 mg/L	8.19	2980
09	Aluminum	30 ug/L	2	2	765 ug/L	0.513	187
09	Zinc	10 ug/L	2	2	35 ug/L	0.0249	9.05
10	Arsenic	5 ug/L	9	12	8.17 ug/L	0.00476	1.73
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	3.56 mg/L	2.43	884
5a	DOC	0.5 mg/L	2	2	7.84 mg/L	5.58	2030
98	Flow			145	516 m3/day		
	Number of Days of Effluent Discharge			364			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

### Company Identification Effluent Identification

ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
21 – Sifto Canada Inc.							
MW 0200 – Minewater Effluent							
03	Hydrogen ion (pH)			150	7.66		
06	Total phosphorus	0.1 mg/L	9	12	0.633 mg/L	0.0406	14.8
08	Total suspended solids	5 mg/L	151	151	350 mg/L	22.9	8370
09	Aluminum	30 ug/L	2	2	95 ug/L	0.00443	1.62
09	Zinc	10 ug/L	2	2	215 ug/L	0.0113	4.13
14	Phenolics (4AAP)	2 ug/L	10	12	15.8 ug/L	0.00117	0.427
17	Toluene	0.5 ug/L	2	2	0.9 ug/L	0.00004	0.0148
19	Di-n-butyl phthalate	3.8 ug/L	2	2	76 ug/L	0.00483	1.76
20	Pentachlorophenol	1.3 ug/L	2	2	4.05 ug/L	0.00018	0.0657
25	Oil and grease	1 mg/L	150	150	249 mg/L	15.8	5780
4a	Ammonia plus Ammonium	0.25 mg/L	12	12	2.37 mg/L	0.167	61
4a	Total Kjeldahl Nitrogen	0.5 mg/L	12	12	3.68 mg/L	0.254	92.9
4b	Nitrate + Nitrite	0.25 mg/L	12	12	2.36 mg/L	0.154	56.1
5a	DOC	0.5 mg/L	2	2	180 mg/L	6.63	2420
5b	TOC, Total Organic Carbon	5 mg/L	2	2	193 mg/L	7.15	2610
30	Chlorides	2 mg/L	151	151	35900 mg/L	2420	883000
8a	Dissolved Solids	20 mg/L	12	12	46300 mg/L	3160	1150000
30	Sulphates	5 mg/L	2	2	1750 mg/L	87.4	31900
98	Flow			146	71.2 m3/day		
	Number of Days of Effluent Discharge			365			
21 – Sifto Canada Inc.							
PW 0100 – Manhole 3A							
03	Hydrogen ion (pH)			150	7.77		
08	Total suspended solids	5 mg/L	77	152	22.3 mg/L	182	59300
09	Zinc	10 ug/L	3	4	32.5 ug/L	0.314	102
25	Oil and grease	1 mg/L	54	152	1.28 mg/L	10.4	3370
4a	Ammonia plus Ammonium	0.25 mg/L	6	12	0.216 mg/L	1.87	809
4a	Total Kjeldahl Nitrogen	0.5 mg/L	4	12	0.367 mg/L	3.21	1040
5a	DOC	0.5 mg/L	4	4	21.5 mg/L	192	62300
30	Chlorides	2 mg/L	152	152	4460 mg/L	34100	11100000
8a	Dissolved Solids	20 mg/L	12	12	6730 mg/L	57600	18700000
30	Sulphates	5 mg/L	4	4	795 mg/L	7370	2400000
98	Flow			152	8180 m3/day		
	Number of Days of Effluent Discharge			325			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Regulated Plants

Company Identification Effluent Identification			RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter							
22	The Canadian Salt Company							
DC	0500 - Dust Collector Effluent							
02	Cyanide Total	0.005 mg/L	6	6	0.622 mg/L	0.249	42.8	
03	Hydrogen ion (pH)			76	7.25			
06	Total phosphorus	0.1 mg/L	3	6	0.165 mg/L	0.0659	11.3	
08	Total suspended solids	5 mg/L	76	76	228 mg/L	91.3	15700	
09	Aluminum	30 ug/L	2	2	275 ug/L	0.11	18.9	
09	Zinc	10 ug/L	2	2	73.5 ug/L	0.0294	5.06	
14	Phenolics (4AAP)	2 ug/L	6	6	5.83 ug/L	0.00233	0.401	
25	Oil and grease	1 mg/L	59	76	4 mg/L	1.6	275	
4a	Ammonia plus Ammonium	0.25 mg/L	6	6	1.49 mg/L	0.595	102	
4a	Total Kjeldahl Nitrogen	0.5 mg/L	4	6	0.8 mg/L	0.32	55	
4b	Nitrate + Nitrite	0.25 mg/L	6	6	1.5 mg/L	0.601	103	
5a	DOC	0.5 mg/L	2	2	11.3 mg/L	4.5	774	
5b	TOC, Total Organic Carbon	5 mg/L	2	2	12.1 mg/L	4.82	829	
30	Chlorides	2 mg/L	68	68	31900 mg/L	12800	2190000	
8a	Dissolved Solids	20 mg/L	6	6	63300 mg/L	25300	4360000	
30	Sulphates	5 mg/L	2	2	620 mg/L	248	42700	
2a	Free Cyanide	0.005 mg/L	2	2	0.0615 mg/L	0.0246	4.23	
98	Flow			76	400 m3/day			
	Number of Days of Effluent Discharge			172				
22	The Canadian Salt Company							
IW	0600 - Intake Water							
03	Hydrogen ion (pH)			123	8.05			
08	Total suspended solids	5 mg/L	99	122	19 mg/L	N/A	N/A	
4b	Nitrate + Nitrite	0.25 mg/L	5	5	1.09 mg/L	N/A	N/A	
30	Chlorides	2 mg/L	122	122	12 mg/L	N/A	N/A	
8a	Dissolved Solids	20 mg/L	16	16	176 mg/L	N/A	N/A	
98	Flow			Not Available				
22	The Canadian Salt Company							
MW	0300 - Mine Water Effluent							
02	Cyanide Total	0.005 mg/L	2	2	0.19 mg/L	0.00908	0.218	
03	Hydrogen ion (pH)			26	7.09			
06	Total phosphorus	0.1 mg/L	9	11	0.379 mg/L	0.023	0.552	
08	Total suspended solids	5 mg/L	26	26	47.9 mg/L	2.58	61.9	
09	Zinc	10 ug/L	2	2	183 ug/L	0.00797	0.191	
14	Phenolics (4AAP)	2 ug/L	10	11	22.8 ug/L	0.00126	0.0302	
25	Oil and grease	1 mg/L	25	26	6.77 mg/L	0.407	9.77	
4a	Ammonia plus Ammonium	0.25 mg/L	11	11	6.41 mg/L	0.32	7.89	
4a	Total Kjeldahl Nitrogen	0.5 mg/L	9	11	3.3 mg/L	0.158	3.79	
4b	Nitrate + Nitrite	0.25 mg/L	11	11	45.1 mg/L	2.16	51.9	
5a	DOC	0.5 mg/L	2	2	11.1 mg/L	0.56	13.4	
30	Chlorides	2 mg/L	26	26	100000 mg/L	5450	131000	
8a	Dissolved Solids	20 mg/L	11	11	162000 mg/L	7500	180000	
30	Sulphates	5 mg/L	2	2	4100 mg/L	204	4890	
98	Flow			26	58 m3/day			
	Number of Days of Effluent Discharge			24				

**MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters**

**Regulated Plants**

Company Identification Effluent Identification				Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter	RMDL	Samples >RMDL				
<b>22 – The Canadian Salt Company</b>							
<b>PW 0100 – E-1 Main Sewer</b>							
03	Hydrogen ion (pH)			159	8.01		
08	Total suspended solids	5 mg/L	121	159	13.4 mg/L	171	62500
09	Aluminum	30 ug/L	4	4	733 ug/L	13.1	4790
14	Phenolics (4AAP)	2 ug/L	8	12	15.9 ug/L	0.18	58.4
4a	Total Kjeldahl Nitrogen	0.5 mg/L	7	12	0.545 mg/L	5.56	2030
4b	Nitrate+Nitrite	0.25 mg/L	12	12	4.91 mg/L	16.8	6050
5a	DOC	0.5 mg/L	4	4	2.88 mg/L	46.4	16900
30	Chlorides	2 mg/L	159	159	1090 mg/L	6190	2260000
8a	Dissolved Solids	20 mg/L	26	26	2170 mg/L	17400	6350000
30	Sulphates	5 mg/L	4	4	58.8 mg/L	1190	433000
98	Flow			159	11000 m3/day		
	Number of Days of Effluent Discharge			365			
<b>28 – 3M Canada Inc.</b>							
<b>OW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			10	8.13		
08	Total suspended solids	5 mg/L	7	10	9.02 mg/L	0.203	9.72
25	Oil and grease	1 mg/L	10	10	1.74 mg/L	0.0893	4.28
4a	Ammonia plus Ammonium	0.25 mg/L	4	5	0.926 mg/L	0.0161	0.77
98	Flow			10	77.7 m3/day		
	Number of Days of Effluent Discharge			48			

MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

Non-regulated Plants

Company Identification							
Effluent Identification							
ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>23 – Brampton Brick Ltd.</b>							
<b>SW 0100 – Stormwater Effluent</b>							
03	Hydrogen ion (pH)			3	7.7		
07	Specific conductance	5 uS/cm	3	3	2130 uS/cm		
08	Total suspended solids	5 mg/L	3	3	60.7 mg/L	36.2	283
30	Fluoride	0.1 mg/L	3	3	1.8 mg/L	0.927	7.23
98	Flow			3	505 m3/day		
	Number of Days of Effluent Discharge			7.8			
<b>24 – Canada Brick, Burlington</b>							
<b>SW 0100 – Stormwater Effluent</b>							
03	Hydrogen ion (pH)			10	7.96		
07	Specific conductance	5 uS/cm	10	10	1310 uS/cm		
08	Total suspended solids	5 mg/L	10	10	283 mg/L	90.7	25600
09	Aluminum	30 ug/L	2	2	11500 ug/L	3.79	1070
09	Zinc	10 ug/L	2	2	104 ug/L	0.0372	10.5
15	Sulphide	0.02 mg/L	2	2	0.08 mg/L	0.055	15.5
25	Oil and grease	1 mg/L	4	10	1.06 mg/L	0.315	88.8
4b	Nitrate+Nitrite	0.25 mg/L	2	2	1.64 mg/L	0.588	186
5a	DOC	0.5 mg/L	2	2	3.65 mg/L	2.61	735
30	Fluoride	0.1 mg/L	10	10	1.85 mg/L	0.509	144
98	Flow			10	306 m3/day		
	Number of Days of Effluent Discharge			282			
<b>25 – Canada Brick, Cooksville</b>							
<b>SW 0100 – Stormwater Effluent – 1</b>							
03	Hydrogen ion (pH)			9	8.17		
07	Specific conductance	5 uS/cm	9	9	1270 uS/cm		
08	Total suspended solids	5 mg/L	9	9	89.4 mg/L	66	10200
09	Aluminum	30 ug/L	2	2	1150 ug/L	0.168	26
09	Zinc	10 ug/L	2	2	175 ug/L	0.0179	2.77
15	Sulphide	0.02 mg/L	2	2	0.02 mg/L	0.00207	0.321
25	Oil and grease	1 mg/L	5	9	1.4 mg/L	0.652	101
4b	Nitrate+Nitrite	0.25 mg/L	2	2	0.645 mg/L	0.0732	11.3
5a	DOC	0.5 mg/L	2	2	4.45 mg/L	0.458	71
30	Fluoride	0.1 mg/L	9	9	1.34 mg/L	0.705	109
98	Flow			9	636 m3/day		
	Number of Days of Effluent Discharge			155			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Non-regulated Plants

Company Identification Effluent Identification			Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter	RMDL					
25 – Canada Brick, Cooksville							
SW 0200 – Stormwater Effluent – 2							
03	Hydrogen ion (pH)			9	8.12		
07	Specific conductance	5 uS/cm	9	9	1330 uS/cm		
08	Total suspended solids	5 mg/L	8	9	174 mg/L	372	57700
09	Aluminum	30 ug/L	2	2	5200 ug/L	0.124	19.3
09	Molybdenum	20 ug/L	2	2	42.5 ug/L	0.00377	0.584
15	Sulphide	0.02 mg/L	2	2	0.025 mg/L	0.00471	0.73
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	1.45 mg/L	0.252	39.1
5a	DOC	0.5 mg/L	2	2	3.35 mg/L	0.394	61.1
30	Fluoride	0.1 mg/L	9	9	0.9 mg/L	0.993	154
98	Flow			8	922 m3/day		
	Number of Days of Effluent Discharge			155			
26 – Canada Brick, Gloucester							
SW 0100 – Stormwater Effluent							
03	Hydrogen ion (pH)			5	8.34		
07	Specific conductance	5 uS/cm	5	5	456 uS/cm		
08	Total suspended solids	5 mg/L	5	5	103 mg/L	194	18800
09	Aluminum	30 ug/L	2	2	1400 ug/L	2.69	281
09	Molybdenum	20 ug/L	2	2	45.5 ug/L	0.0876	8.5
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	5.3 mg/L	10.2	985
5a	DOC	0.5 mg/L	2	2	8.35 mg/L	16.3	1580
30	Fluoride	0.1 mg/L	5	5	0.44 mg/L	0.97	94.1
98	Flow			5	2320 m3/day		
	Number of Days of Effluent Discharge			97			
27 – Canada Brick, Streetsville							
SW 0100 – Stormwater Effluent							
03	Hydrogen ion (pH)			12	7.71		
07	Specific conductance	5 uS/cm	12	12	428 uS/cm		
08	Total suspended solids	5 mg/L	11	12	48.4 mg/L	56	20400
09	Aluminum	30 ug/L	2	2	1480 ug/L	0.614	224
09	Zinc	10 ug/L	2	2	65 ug/L	0.0274	9.98
15	Sulphide	0.02 mg/L	2	2	0.04 mg/L	0.0227	8.3
25	Oil and grease	1 mg/L	11	12	1.84 mg/L	0.926	338
4b	Nitrate+ Nitrite	0.25 mg/L	2	2	0.415 mg/L	0.183	66.9
5a	DOC	0.5 mg/L	2	2	4.95 mg/L	2.27	829
30	Fluoride	0.1 mg/L	12	12	2.03 mg/L	1.09	397
98	Flow			12	538 m3/day		
	Number of Days of Effluent Discharge			365			
29 – Amherst Quarries Ltd.							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			51	7.59		
08	Total suspended solids	5 mg/L	42	49	12.6 mg/L	19.5	7060
25	Oil and grease	1 mg/L	27	49	2.88 mg/L	4.32	1560
98	Flow			51	1540 m3/day		
	Number of Days of Effluent Discharge			361			

# MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters

## Non-regulated Plants

Company Identification		Effluent Identification						
ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)	
30 - Boyce Quarry								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			34	8.12			
98	Flow			33	2880 m3/day			
	Number of Days of Effluent Discharge			238				
31 - Carden Quarry								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			39	7.92			
08	Total suspended solids	5 mg/L	18	39	10.6 mg/L	2.78		205
4a	Ammonia plus Ammonium	0.25 mg/L	7	10	0.498 mg/L	0.255		18.9
98	Flow			40	275 m3/day			
	Number of Days of Effluent Discharge			74				
32 - Permanent Concrete Ltd.								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			52	8.03			
08	Total suspended solids	5 mg/L	28	52	7.95 mg/L	12.4		4310
98	Flow			46	1960 m3/day			
	Number of Days of Effluent Discharge			347				
33 - Dufferin Quarry								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			51	7.45			
08	Total suspended solids	5 mg/L	17	49	5.69 mg/L	46.5		15400
25	Oil and grease	1 mg/L	27	52	2.05 mg/L	13		4310
98	Flow			52	7570 m3/day			
	Number of Days of Effluent Discharge			331				
34 - Elginburg Quarry								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			7	8.26			
98	Flow			7	1080 m3/day			
	Number of Days of Effluent Discharge			10				
35 - Fallowfield Quarry								
QW 0100 - Quarrywater Effluent								
03	Hydrogen ion (pH)			10	8.09			
08	Total suspended solids	5 mg/L	5	10	14.1 mg/L	20.4		735
98	Flow			9	663 m3/day			
	Number of Days of Effluent Discharge			36				

**MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters**  
**Non-regulated Plants**

Company Identification Effluent Identification		RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
ATG	Parameter						
36 – Flamboro Quarries Ltd.							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			51	7.45		
08	Total suspended solids	5 mg/L	32	51	11.3 mg/L	13.4	3330
25	Oil and grease	1 mg/L	27	51	2.44 mg/L	2.6	647
98	Flow			52	1920 m3/day		
	Number of Days of Effluent Discharge			249			
37 – N & S Francon Quarries							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			47	8.14		
08	Total suspended solids	5 mg/L	26	47	8.72 mg/L	17.7	5190
4a	Ammonia plus Ammonium	0.25 mg/L	4	12	2.29 mg/L	0.537	157
98	Flow			47	2020 m3/day		
	Number of Days of Effluent Discharge			293			
38 – R.E. Law Quarry							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			50	7.91		
08	Total suspended solids	5 mg/L	15	50	4.24 mg/L	59.9	13200
14	Phenolics (4AAP)	2 ug/L	4	12	5.39 ug/L	0.0757	18.7
25	Oil and grease	1 mg/L	26	50	1.41 mg/L	19.9	4370
4a	Ammonia plus Ammonium	0.25 mg/L	5	12	0.22 mg/L	3.09	680
98	Flow			50	14100 m3/day		
	Number of Days of Effluent Discharge			220			
39 – Bertrand and Frere							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			22	8.09		
08	Total suspended solids	5 mg/L	17	22	46.1 mg/L	11.7	971
98	Flow			15	1150 m3/day		
	Number of Days of Effluent Discharge			83			
40 – MacClead Quarry							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			23	8.03		
98	Flow			22	604 m3/day		
	Number of Days of Effluent Discharge			89			
41 – Milton Limestone							
QW 0100 – Quarrywater Effluent							
03	Hydrogen ion (pH)			52	7.74		
08	Total suspended solids	5 mg/L	27	52	6.29 mg/L	9.06	1200
25	Oil and grease	1 mg/L	26	52	2.19 mg/L	2.44	324
98	Flow			52	1490 m3/day		
	Number of Days of Effluent Discharge			133			

**MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters**

**Non-regulated Plants**

Company Identification Effluent Identification							
ATG	Parameter	RMDL	Samples >RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<b>42 – Nelson Quarry</b>							
<b>QW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			49	7.69		
08	Total suspended solids	5 mg/L	15	49	113 mg/L	407	145000
25	Oil and grease	1 mg/L	25	47	1.42 mg/L	6.53	2320
4a	Ammonia plus Ammonium	0.25 mg/L	9	12	0.645 mg/L	2.83	1010
98	Flow			49	4390 m3/day		
	Number of Days of Effluent Discharge			356			
<b>42 – Nelson Quarry</b>							
<b>WW 0200 – Washwater Effluent</b>							
03	Hydrogen ion (pH)			52	7.86		
08	Total suspended solids	5 mg/L	31	52	14.4 mg/L	41.5	15200
25	Oil and grease	1 mg/L	29	50	1.27 mg/L	3.86	1410
98	Flow			52	2900 m3/day		
	Number of Days of Effluent Discharge			365			
<b>43 – Richier Quarry</b>							
<b>QW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			22	8.07		
08	Total suspended solids	5 mg/L	7	22	4.58 mg/L	0.476	20.5
98	Flow			22	119 m3/day		
	Number of Days of Effluent Discharge			43			
<b>44 – Ridgemount Quarries Ltd.</b>							
<b>QW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			32	7.91		
08	Total suspended solids	5 mg/L	10	32	5.66 mg/L	25.2	4990
25	Oil and grease	1 mg/L	19	32	1.31 mg/L	5.75	1140
98	Flow			32	4380 m3/day		
	Number of Days of Effluent Discharge			198			
<b>45 – Uthloff Quarry</b>							
<b>QW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			50	8.07		
08	Total suspended solids	5 mg/L	11	50	7.78 mg/L	77.3	25400
25	Oil and grease	1 mg/L	29	50	1.38 mg/L	12.1	3970
98	Flow			51	8790 m3/day		
	Number of Days of Effluent Discharge			328			
<b>48 – Allan G. Cook Ltd.</b>							
<b>QW 0100 – Quarrywater Effluent</b>							
03	Hydrogen ion (pH)			42	7.77		
08	Total suspended solids	5 mg/L	9	42	4.95 mg/L	1.46	405
25	Oil and grease	1 mg/L	21	40	4.48 mg/L	1.44	400
98	Flow			41	284 m3/day		
	Number of Days of Effluent Discharge			277			

**MISA Industrial Minerals Sector – Average Concentrations and Loadings for Found Parameters**  
**Non – regulated Plants**

Company Identification							
Effluent Identification							
ATG	Parameter	RMDL	Samples > RMDL	Number of Samples	Average Concentration	Average Loading (kg/day)	Annual Loading (kg/year)
<hr/>							
47 – Kam Aggregates Ltd.							
WW 0100 – Washwater Effluent							
03	Hydrogen ion (pH)			21	7.93		
08	Total suspended solids	5 mg/L	21	21	27.4 mg/L	83.2	10400
14	Phenolics (4AAP)	2 ug/L	6	6	7 ug/L	0.0199	2.48
25	Oil and grease	1 mg/L	21	21	2.96 mg/L	8.45	1060
98	Flow			21	2770 m3/day		
	Number of Days of Effluent Discharge			125			

### APPENDIX III

#### THE BAT CONSULTANTS TREATABILITY TABLES



**TABLE 1-2**  
**SUMMARY OF PRIORITY PARAMETERS**  
**WITHIN THE NON-METALLIC MINERALS DIVISION**

Parameter	Associated With Production of:	Possible Source	Regulated Within the Non-Metallic Minerals Division	Treatability
Total Suspended Solids	All categories	Process-related	Yes	Treatable at levels present
Oil and Grease	Sa, Gy, Li, Ce, Gr	Process-related	Yes	Generally not treatable at levels present*
Ammonia/Ammonium	Gy, Li, Ce, Ma, Ba, Sa	Explosive use (ANFO)/agricultural	No	Generally not treatable at levels present*
TKN	Only monitored at salt	Explosive use	No	Not treatable at levels present
Phenolics	Sa, Gy, Li, Ce, Gr, NS	Natural/process-related	No	Not treatable at levels present*
pH	Cement, lime	Process-related	Yes	Treatable at levels present
Chloride	Cement, lime, gypsum, salt	Natural/process-related/road maintenance	Yes (salt only)	Not treatable at levels present
Sulphate	Cement, lime, gypsum, salt	Natural	No	Not treatable at levels present
Specific conductance	Sa, Li, Ce, Gy, Ma, Ta	Natural/process-related	No	Not treatable at levels present
Cyanide	Ma, Li, Sa	Process-related	No	Not treatable at levels present
Total Phosphorus	Ta, Gy, Sa	Process-related/unknown	No	Not treatable at levels present
Dissolved Organic Carbon	Sa, Gy, Li, Ce, Ma, Ta	Natural, process-related	No	Not treatable at levels present
Pentachlorophenol	Ta, Sa, Ma	Unknown/Natural	No	Not treatable at levels present
4 - Nitrophenol	Magnesium, talc	Unknown/Natural	No	Not treatable at levels present

\* Treated incidentally by means of natural degradation during suspended solids treatment.

Sa - Salt      Gr - Graphite      Ta - Talc  
 Gy - Gypsum      Li - Lime      Ba - Basalt  
 Ce - Cement      Ma - Magnesium      NS - Nepheline Syenite

**TABLE 1-2 (cont'd)**  
**SUMMARY OF PRIORITY PARAMETERS**  
**WITHIN THE NON-METALLIC MINERALS DIVISION**

Parameter	Associated With Production of:	Anticipated Source	Regulated Within the Non-Metallic Minerals Division	Treatability
M-, C-, P-Cresol	Lime <sup>1</sup>	Unknown	No	Not treatable at levels present
Phenol	Lime <sup>1</sup>	Unknown/Natural	No	Not treatable at levels present
2, 4-Dimethylphenol	Lime <sup>1</sup>	Unknown/Natural	No	Not treatable at levels present
Di-n-butyl Phthalate	Gypsum <sup>1</sup> , salt <sup>1</sup>	Unknown	No	Not treatable at levels present
Toluene	Talc <sup>**</sup> , salt <sup>1</sup>	Process-related	No	Not treatable at levels present
Zinc	Gy, Ce, Gr, Ta, Ma	Natural	No	Not treatable at levels present***
Cadmium	Talc <sup>**</sup>	Natural	No	Not treatable at levels present***
Nickel	Li, Ma, Ta	Natural	No	Not treatable at the levels present***
Vanadium	Lime <sup>1</sup>	Unknown	No	Not treatable at the levels present***
Cobalt	Talc <sup>1</sup> **, magnesium	Natural	No	Not treatable at the levels present***
Copper	Lime <sup>1</sup> **	Unknown	No	Not treatable at the levels present***
Aluminum	Ce, Li, Gy, Ta	Natural	No	Not treatable at the levels present***
Arsenic	Talc	Natural	No	Not treatable at the levels present***
Antimony	Talc <sup>1</sup> **	Natural	No	Not treatable at the levels present***
Sulphide	Cement, gypsum	Natural	No	Not treatable at the levels present

\* Treated by means of natural degradation during suspended solids treatment.

\*\* At levels close to RMDL.

\*\*\* Levels may decrease with suspended solids treatment.

<sup>1</sup> At one operation only.

Sa - Salt      Gr - Graphite      Ta - Talc  
 Gy - Gypsum      Li - Lime      Ba - Basalt  
 Ce - Cement      Ma - Magnesium      NS - Nepheline Syenite

**TABLE 1-2**  
**SUMMARY OF PRIORITY PARAMETERS**  
**WITHIN THE AGGREGATES DIVISION**

Parameter	Number of Plants	Possible Source	Regulated Within the Aggregate Div.	Comments
Total Suspended Solids	4 Brick 15 Quarries 1 Sand & Gravel	Process-related	Yes	Treatable at levels present
Oil and Grease	3 Brick 10 Quarries 1 Sand & Gravel	Process-related	Yes	Generally not treatable at levels present
Specific Conductance	4 Brick 1 Quarry	Natural/process-related	No	Not treatable at levels present
Dissolved Organic Carbon (DOC)	4 Brick 1 Quarry	Natural	No	Not treatable at levels present
Ammonia/Ammonium	4 Quarries	Explosive use (ANFO/agricultural)	No	Not treatable at levels present ***
Nitrate/Nitrite	4 Brick 1 Quarry	Natural, explosive use/agricultural	No	Not treatable at levels present ***
Phenolics	1 Brick** 1 Quarry	Natural	No	Not treatable at levels present ***
Sulphide	3 Brick**	Natural	No	Not treatable at levels present
Fluoride	4 Brick	Process-related	No	Not treatable at levels present
Zinc	3 Brick 1 Quarry**	Natural	No	Not treatable at levels present*
Aluminum	4 Brick	Natural	No	Not treatable at levels present*
Molybdenum	2 Brick	Natural	No	Not treatable at levels present*
Cyanide	1 Quarry	Unknown	No	Not treatable at levels present

\* Anticipate suspended solids treatment may decrease levels.

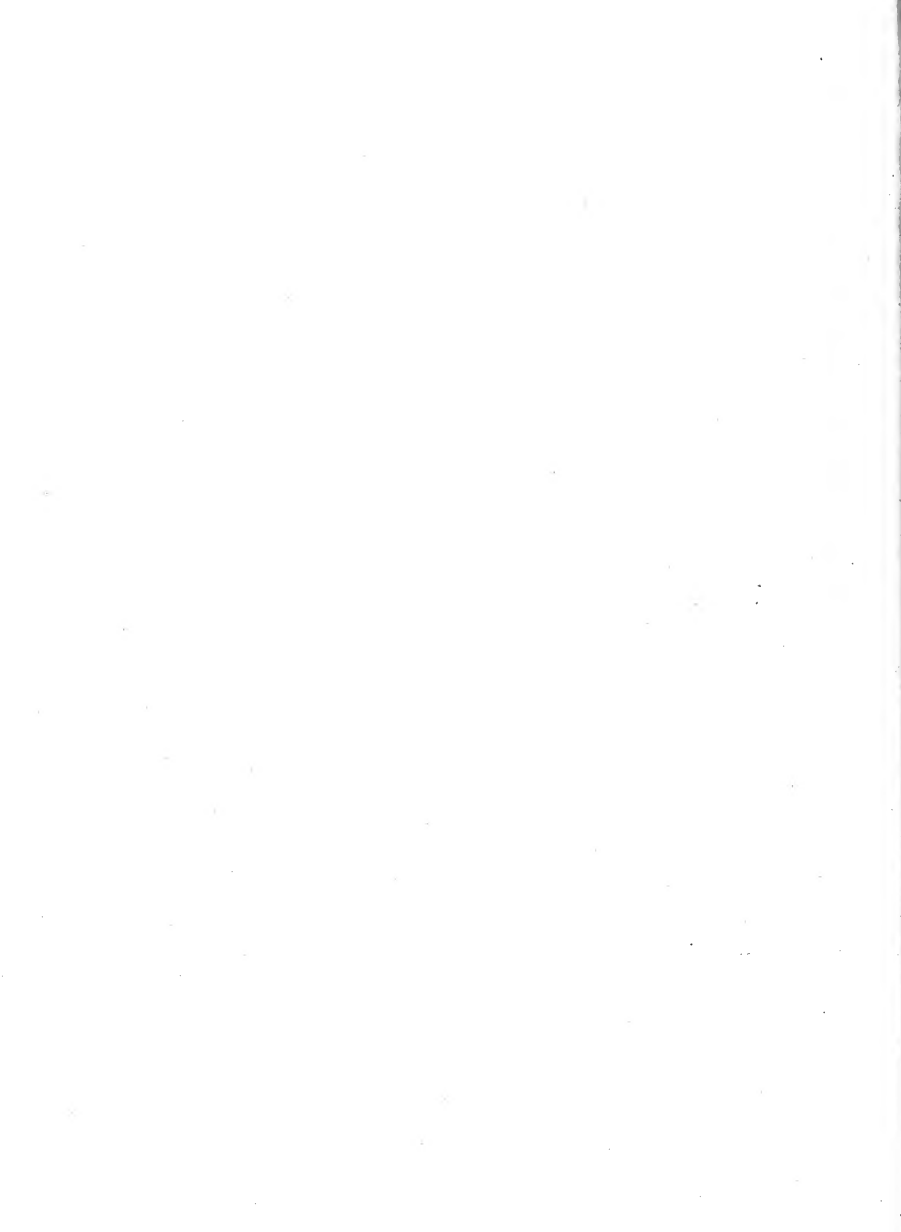
\*\* At concentrations of close to RMDL

\*\*\* Treated incidentally by means of natural degradation during suspended solids treatment.



APPENDIX IV

CYANIDE ANALYTICAL TERMINOLOGY



# Cyanide Analysis

## Cyanide Speciation in Wastewater

### Chemical Compound

### Analytical Terminology

HCN Cyanuric Acid

$\text{CN}^-$  Cyanide Ion

$\text{Zn}(\text{CN})_4^{2-}$

Zinc Cyanide

$\text{Cd}(\text{CN})_4^{2-}$

Cadmium Cyanide

$\text{Cu}(\text{CN})_4^{3-}$

Copper Cyanide

$\text{Cu}(\text{CN})_3^{2-}$

Copper Cyanide

$\text{Cu}(\text{CN})_2^{-1}$

Copper Cyanide

$\text{Ni}(\text{CN})_4^{1-}$

Nickel Cyanide

$\text{Au}(\text{CN})_2^{2-}$

Gold Cyanide

$\text{Co}(\text{CN})_6^{4-}$

Cobalt Cyanide

$\text{Fe}(\text{CN})_6^{4-}$

Iron Cyanide

Cyanide (WAD)  
(Weak Acid Dissociable)

CNW or  
CNP  
(Oxidizable Cyanide)

CNT  
(Total Cyanide)

